

United States naval medical bulletin.

Washington : U.S. Govt. Print. Off., for sale by Supt. of Docs.

<http://hdl.handle.net/2027/uc1.b2951837>

HathiTrust

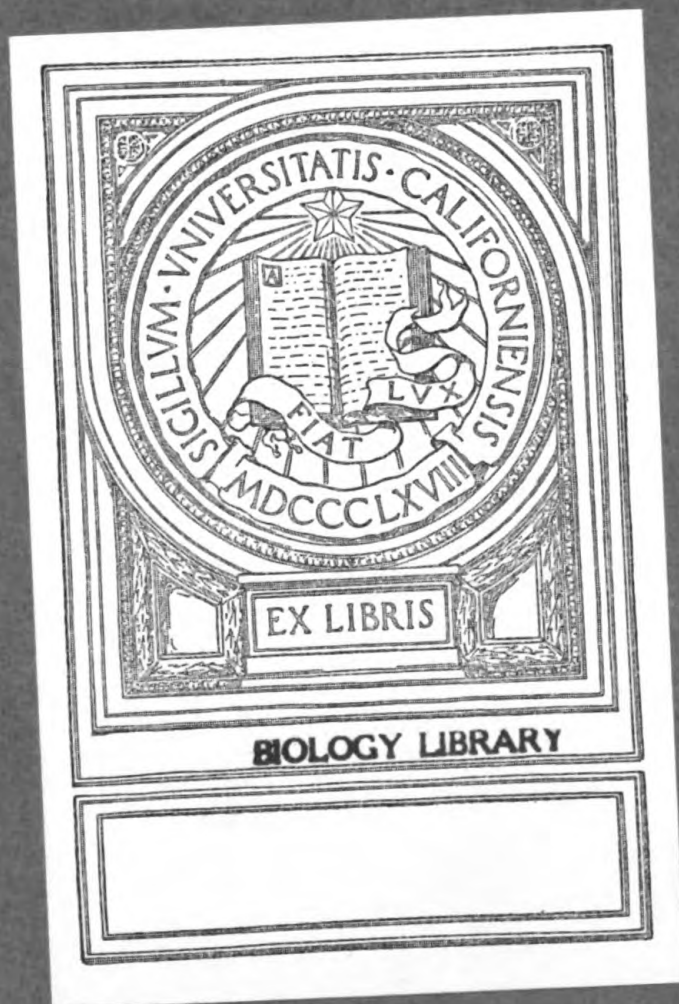


www.hathitrust.org

Public Domain, Google-digitized

http://www.hathitrust.org/access_use#pd-google

We have determined this work to be in the public domain, meaning that it is not subject to copyright. Users are free to copy, use, and redistribute the work in part or in whole. It is possible that current copyright holders, heirs or the estate of the authors of individual portions of the work, such as illustrations or photographs, assert copyrights over these portions. Depending on the nature of subsequent use that is made, additional rights may need to be obtained independently of anything we can address. The digital images and OCR of this work were produced by Google, Inc. (indicated by a watermark on each page in the PageTurner). Google requests that the images and OCR not be re-hosted, redistributed or used commercially. The images are provided for educational, scholarly, non-commercial purposes.



55

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 43

NUMBER 1

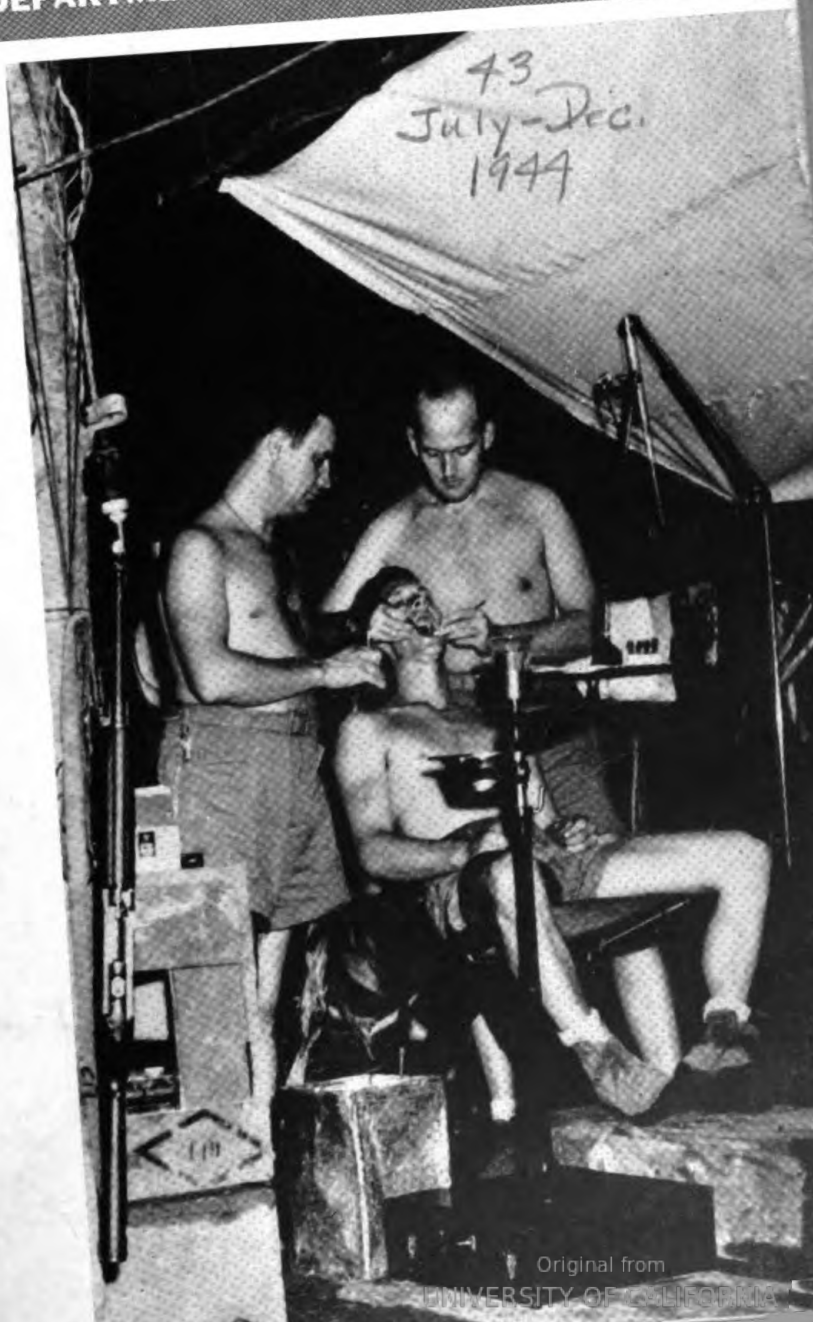


JULY 1944

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAV MED 112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

TO VIMU
AIRBORNE

COVER PHOTOGRAPH

Oral hygiene follows United States Marines wherever they go, even when their mission leads them into the wilds of Bougainville. At an aid station behind the lines a patient keeps an appointment with a portable dental unit, a Naval dental officer and the latter's pharmacist's mate assistant.

—Official U. S. Navy Photo.

VOL. 43

JULY 1944

NO. 1

UNITED STATES NAVAL MEDICAL BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of Naval Appropriation
Act for fiscal year 1944, Public Law No. 92, approved June 26, 1943

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page ii for prices

BIOLOGY LIBRARY

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE,
Surgeon General, United States Navy.

III

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain-paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

	Page
PREFACE	iii
NOTICE TO CONTRIBUTORS	iv
SPECIAL ARTICLES	
Rheumatic Fever and Acute Arthritis as Causes for Evacuation from South Pacific Area — <i>Howard B. Sprague and Sylvester McGinn</i>	1
Acute Ascending Paralysis (Guillain-Barré Syndrome) — <i>Patrick J. Fitzgerald and Harold Wood</i>	4
Infectious Polyneuritis; A Report of Four Cases — <i>A. Warren Stearns and Herbert I. Harris</i>	13
Dermatologic Practice in the South Pacific; A Review of 1,500 Cases — <i>Charles T. Bingham and Ronald L. Macke</i>	17
Factors in Efficient Mass Blood Procurement — <i>K. P. A. Taylor</i>	25
The Safe Universal Donor — <i>Edward A. Mullen</i>	32
Airsickness — <i>Russell G. Witwer</i>	34
Ultraviolet Irradiation Relative to Anoxia and Bend Susceptibility; Preliminary Investigation — <i>William M. Davidson</i>	37
Experiment in Psychotherapy During Selection Examining — <i>James H. Closson and Harold M. Hildreth</i>	39
Experiences in the Use of the Kent Battery — <i>J. A. Wheeler, Jr., Stanley B. Williams, William A. Drummond, Jr., and John D. Harris</i>	44
The Changing Picture of Postpneumonic Empyema Thoracis Complicating Sulfonamide-Treated Pneumonia — <i>Clifford D. Benson and Charles W. McLaughlin, Jr.</i>	46
Precision Bombing in Chemotherapy — <i>Alvin F. Coburn</i>	52
Evaluation of Micraform Sulfathiazole in the Treatment of Parodontosis (Pyorrhea Alveolaris) — <i>Joseph S. Restarski and James L. Bradley</i>	59
Knee Injuries in Service Personnel — <i>John H. Allan and Jesse T. Nicholson</i> ..	63
Surgical Casualties of Amphibious Warfare — <i>L. Kraeer Ferguson</i>	73
Reno-Ureteral Colic In the South Pacific Area — <i>McCleery Glazier and Clarence Olson</i>	80
Autoplastic Sutures in Repair of Inguinal Hernia — <i>George G. Chiles and Harry F. Lenhardt</i>	83
Temporary Stimulation of Emmetropic Visual Acuity — <i>James E. Lebensohn and Raymond R. Sullivan</i>	90

	Page
Cosmetic Ocular Rehabilitation— <i>Marvin J. Blaess</i>	96
Application of Caudal Anesthesia to General Surgery— <i>William M. Russell and James E. Conley</i>	100
Anesthesia in Military Medicine; Administration by the Unskilled— <i>Mortimer B. Genauer</i>	105
Procaine Hydrochloride 4-Percent; Indications for Use— <i>John C. Farquhar</i> ..	111
Analysis of Low Incidence of Infectious Diseases at a Secondary Training Center— <i>William V. Lulow and H. B. Benjamin</i>	114

CLINICAL NOTES

Mediastinal Emphysema; Report of Two Cases— <i>James T. Cowart</i>	119
Coccidioidomycosis; Report of Unsuccessful Treatment With Penicillin— <i>Paul Michael, Richard F. McLaughlin, and Phillip L. Cenac</i>	122
Neurinoma of the Mental Nerve; Report of Case— <i>Bruno E. Amyot</i>	125
Normal Blood Elements and Leptospira— <i>Louis Shattuck Baer and Ralph F. Allen</i>	127
Progressive Muscular Dystrophy; Report of a Case— <i>Tully T. Blalock</i> ...	129
Inflammation of the Macula Lutea; Report of a Case— <i>Albert J. Brinckerhoff</i>	133
Impetigo Contagiosa Cured by Fever; Report of a Case— <i>Oscar Greene</i> ...	136
Multiple Chancres; A Case Report— <i>Lucian W. DiLeo and Francis T. Kelly</i>	137

MEDICAL AND SURGICAL DEVICES

Anticoncussion Ear Plugs; Prevention of Aural Complications from Gunnery Concussion— <i>Lawrence K. Cox and John W. Geller</i>	139
A Simple Night Vision Test— <i>Lawrence L. Bean</i>	143
Protector Sleeve for Hypodermic Syringe— <i>Truman O. Anderson</i>	147
Methods of Obtaining Suction in the Field— <i>Sidney L. Arje and Robert B. Venner</i>	150
Emergency Poison Kit— <i>William D. Stubenbord</i>	154
A Simple Method of Securing Patients to Army-Type Litter— <i>Daniel J. Sullivan</i>	157
Processing X-Ray Film Under Tropical Conditions— <i>A. Porter S. Sweet</i> ..	160

EDITORIALS

Caudal Anesthesia.....	163
Surgeon or Injectionist.....	164
Dye Delineation of Sinus Tracts.....	166

BOOK NOTICES

	Page
Clinical Tropical Medicine, 27 authors; edited by <i>Bercovitz</i> —A Manual of Medical Parasitology, <i>Huff</i> —White Blood Cell Differential Tables, <i>Waugh</i> —The Wounded Get Back, <i>Maisel</i> —What is Hypnosis, <i>Salter</i> —Allergy, Anaphylaxis and Immunotherapy, <i>Ratner</i> —The Modern Management of Colitis, <i>Bargen</i> —Medical Radiographic Technic, prepared by Technical Service Department of General Electric X-Ray Corporation—Lincoln-Douglas, the Weather and Destiny, <i>Petersen</i> —The Hospital in Modern Society, 98 contributors; edited by <i>Bachmeyer</i>	167

PREVENTIVE MEDICINE

Medical Department of a Labor Board— <i>Newton T. Saxl</i>	175
Experimental Prophylaxis and Treatment of Chancroidal Infection; Inefficacy of Penicillin Administered Intramuscularly— <i>Armand J. Pereyra and Simeon Landy</i>	189
Results of Penicillin Treatment of Sulfonamide-Resistant Gonorrhea— <i>Walter H. Schwartz and Cary O. Edge</i>	193
STATISTICS: Health of the Navy.....	197
NOTES ON OUR RESERVE CONTRIBUTORS.....	199

U. S. NAVAL MEDICAL BULLETIN

Vol. 43

July 1944

No. 1

SPECIAL ARTICLES

RHEUMATIC FEVER AND ACUTE ARTHRITIS AS CAUSES FOR EVACUATION FROM SOUTH PACIFIC AREA

HOWARD B. SPRAGUE
Captain (MC) U. S. N. R.

and

SYLVESTER MCGINN
Lieutenant Commander (MC) U. S. N. R.

The occurrence of rheumatic fever in the tropics has become of practical importance in naval and military logistics through the invaliding of personnel with either primary or recurrent attacks. That rheumatic fever exists, even among natives in tropical areas, is now established. The senior author has recently examined in the native hospital at Suva, an East Indian boy of 18, born in the Fiji Islands, who was suffering from an acute rheumatic attack and who had developed aortic regurgitation.

This report summarizes the experience of a hospital ship in transporting sick and wounded from the combat area of the Solomon Islands and adjacent waters, and from the New Hebrides and New Caledonia, between 1 July 1942 and 1 July 1943; and the experience of a Naval base hospital in New Zealand from 8 September 1942 to 13 September 1943.

During the period mentioned the ship admitted 22 patients who were considered as having rheumatic fever and 13 who had acute arthritis which was not sufficiently characteristic for the diagnosis of rheumatic fever. If these may be considered as one group the percentage of cases attributable to acute, nontraumatic, nonvenereal arthritis was 0.38 percent.

The histories of these patients are incomplete so far as records of previous attacks of joint pains or acute episodes are concerned. In 10 instances, however, the current attack of joint pain and swelling was the first one, if the patient's statement could be accepted. In 9 cases there was a definite history of previous rheumatic fever or acute joint

inflammation. In 6 of these where the record was satisfactory, the primary attack could be dated from 2 to 4 years previously; in one, a man of 31 years of age, the first attack had occurred at the age of 10. Twenty-five of the patients were under 30 years of age at the time of the current attack and 10 were over 30, the oldest being 40 and 42 years of age. The attack in the man of 40 followed a tooth extraction.

Precipitating factors for the attack.—In only relatively few instances were the records on the ship sufficiently detailed to determine any unusual factors which could be considered activating mechanisms for the attacks of rheumatism. The short observation period during the evacuation of combat casualties precluded the taking of long histories, particularly as the demands upon the medical officers were mainly surgical and of an emergency nature. However in seven instances it was noted in the history that the attacks of rheumatism or acute arthritis followed episodes of:

	<i>Number of cases</i>
Sore throat.....	2
Sore throat and otitis media.....	1
Cold and otitis media.....	1
Tooth extraction.....	1
Nonspecific prostatitis.....	1
Malaria and bacillary dysentery.....	1

In other instances it must be assumed that the factors of fatigue, variations in temperature, high humidity, heat exhaustion, exposure to chilling in rainstorms or in sea water, and the malaise of chronic malaria were operative.

No bacteriologic study of throat cultures was made, and electrocardiograms were recorded in very few cases because of the emergency requirements in treatment of the wounded and because electrocardiograms taken at sea are distorted by vibration and are not satisfactory for determining details such as minor variations in the P-R interval. Cardiac involvement was clinically suspected in only 4 cases.

From 8 September 1942 to 13 September 1943 fourteen cases of rheumatic fever were admitted to the base hospital.¹ These patients remained long enough in the hospital for the diagnosis to be established accurately and were under the personal observation of the junior author. X-ray and electrocardiographic facilities were available.

In addition 20 patients had acute arthritis. Thus a total of 34 patients had acute joint disease of nontraumatic origin. Disability from this cause was found, therefore, in 0.26 percent of admissions, a figure which, allowing for the readmissions to the base hospital, is significantly close to the hospital ship experience.

¹ The use of the term "admitted" is intended to indicate that the authors' observation and study of patients and records resulted in the diagnosis being accepted as final rather than that these were necessarily "admission" diagnoses.

Using an approximate number for patients admitted to this hospital ship and base hospital, 0.17 percent represents a total admission attributable to rheumatic fever.²

Similarly if the 34 cases of rheumatic fever and the 33 cases of acute arthritis are combined, the disability from acute "rheumatic" infection involving joints is 0.33 percent. It is of interest that the incidence of rheumatic fever in adults in the public hospital at Wellington, New Zealand, from 1938-43 is 0.3 percent. The total number of patients with rheumatic valvular disease treated in these 2 Naval activities during this period was 11, or 0.055 percent.

SUMMARY

1. Rheumatic fever and acute arthritis as seen aboard a hospital ship evacuating patients from tropical combat areas in the South Pacific accounted for 0.38 percent of the casualties in the year 1 July 1942-1 July 1943.

2. These conditions as seen at a base hospital in New Zealand during practically the same period showed an incidence of 0.26 percent of the total admissions.

3. It is estimated that rheumatic fever accounts for approximately 0.17 percent of all causes for evacuation from this area, and combined with acute arthritis the total is 0.33 percent.

4. It is considered probable that factors of fatigue, exposure and upper respiratory infection are activating mechanisms precipitating rheumatic fever attacks or recrudescences in tropical areas, as they are in temperate climates.

² There were 22 cases of rheumatic fever on the hospital ship and 14 in the base hospital, but 2 of those in the hospital had also been on the ship and were included in the ship's figures.



SPASMOLYTIC ACTION OF DEMEROL

Some of the analgesic effectiveness is no doubt in part due to the spasmolytic action of the drug. It relaxes the gastrointestinal tract—the tone and the segmental contractions are diminished, but the propulsive peristalsis remains undisturbed. As a consequence, the drug relieves colicky pain quickly yet is ineffective in checking diarrhea, and does not cause constipation as do the opiates. In biliary and ureteral tract spasm, the drug also has a relaxing effect, but in severe attacks it may not adequately afford relief. In asthma, beneficial results have been reported.—QUICK, A. J., and TATUM, A. L.: Comments on treatment. *Wisconsin M. J.* 43: 326, March 1944.

ACUTE ASCENDING PARALYSIS (GUILLAIN-BARRÉ SYNDROME)

PATRICK J. FITZGERALD

Lieutenant (MC) U. S. N. R.

and

HAROLD WOOD

Lieutenant Commander (MC) U. S. N. R.

In military life acute ascending paralysis is rare. When it occurs, it is dramatic and incapacitating. Various names have been applied to a form of flaccid paralysis appearing in the lower extremities, extending up the trunk, and frequently involving the bulbar nerves with subsequent fatality. Landry's paralysis (1) (6); infectious polyneuritis (Guillain-Barré syndrome) or polyradiculoneuritis (2) (3) (6) (9-17); acute anterior poliomyelitis (3) (18-20); acute ascending necrotic myelitis (4) (26)—these are among the many names by which this clinical syndrome is known (5) (21-25).

A case is reported here of a 20-year-old apprentice seaman who died of a rapidly ascending paralysis about 24 hours after the onset of neurologic symptoms. Death was probably the result of infectious polyneuritis (Guillain-Barré syndrome) in which there was an unusually rapid course. It is of interest that the disease, infectious polyneuritis, was first considered to be benign (2) (8). Later Fox and O'Connor (9) found a 20-percent mortality in a review of 126 cases and pointed out that half the deaths reviewed occurred in troops during World War I, as reported by Casamajor (11). Forster, Brown, and Merritt (12) found a 42-percent mortality in their 26 cases studied over a period of 10 years. They emphasized, however, that, whereas the mortality up to 1937 was 19 percent, there were 8 deaths in the 10 cases studied from 1938-40. The rapidly fatal course in the case to be reported here raises the question as to whether the disease is becoming more virulent, and leads to speculation as to what course it might take in a Naval station where military exigencies require the bringing together of many men.

Since the description in 1859 by Octave Landry (1) of a fatal case of acute ascending paralysis in which there were no changes of sensation, muscular atrophy, or disturbances of the sphincters, and in which postmortem examination revealed no abnormalities, a syndrome has been recognized to which the name Landry's paralysis has been given. A healthy person exhibits only mild prodromes before he develops sudden flaccid paralysis of the lower extremities which rapidly ascends and affects the abdominal and intercostal muscles, the upper extremities, and finally, if progressive, those muscles supplied by the bulbar

nerves, with ensuing fatality. Death may occur in a few days or weeks, or, more commonly, complete recovery occurs. Almost every major infectious disease, many vaccines, antitoxins, chemicals, vitamin deficiencies, bacteria, and viruses have been advanced as etiologic factors, as De Jong (6) has pointed out in his review; but no one agent has been constantly and conclusively associated with the syndrome. The histopathology in fatal cases has been so varied, and the detailed clinical manifestations so different that the syndrome has been differentiated into many distinct disease entities.

Infectious polyneuritis, or polyradiculoneuritis, received recognition with the publication by Guillain, Barré, and Strohl (2) in 1916, although Osler (7) in 1892 and Laurens (8) in 1908 had previously described a similar condition. The Guillain-Barré syndrome, as it is generally known, is characterized by ascending motor disturbances; loss of tendon jerks with preservation of cutaneous reflexes; paresthesias with slight changes of objective sensitivity; muscle tenderness, and significant increase of the protein of the cerebrospinal fluid, with a normal or low cell count (cyto-albuminose dissociation).

Fox and O'Connor (9) have reviewed the literature and state that the disease equally affects both sexes throughout all age groups, but 70 percent of the cases occur between 20 and 50 years with 25 percent below 20 years. About one-third of the patients give a history of recent illness, usually a mild upper respiratory disorder, or vague aches, pains, and gastro-intestinal disturbances. Fever is either slight or absent. Most patients show progressive ascending paralysis, usually beginning in the legs, which is accompanied in about 50 percent of the cases with sensory changes, such as pain, paresthesias, and anesthetics. Motor weakness is striking, for the most part bilateral, and in about one-third of the cases progresses to facial diplegia. About 13 percent of the cases show other cranial nerve involvements. Abdominal and deep reflexes are absent in about half the cases. Death has occurred as early as the second day after onset of neurologic symptoms (16), although in most of the fatal cases reported, death occurred within several weeks. Survivors of the disease generally show slow complete recovery with an average recovery period of 57 weeks, but varying from 6 weeks to 3 years (12). Permanent impairment has been reported (12) (13). The laboratory observations of significance are those of the cerebrospinal fluid (9), for 56 of 71 cases showed significantly increased protein, with a normal cell count in 85 of 101 cases. The pressure of the spinal fluid is usually normal.

The pathologic lesions found in the Guillain-Barré syndrome are for the most part those of the peripheral nerves. Bradford, Bashford, and Wilson (14) examined six patients with the disease and reported as gross findings edema of the brain and spinal cord with a few petechial hemorrhages. Microscopic examination revealed degeneration of

some of the anterior and posterior horn cells, but the principal lesion was an acute neuritis, more marked in motor than in sensory nerves and more severe in the lower extremities than the upper, and patchy wallerian degeneration with proliferation of the cells of Schwann. Casamajor (11) noted an increase of cellular neuroglia in the central gray matter, around the root fibers, and in the posterior root ganglions. Gilpin, Moersch, and Kernohan (15) studied three cases that showed degenerative changes limited to the peripheral nerves. They reported proliferation of the cells of the sheath of Schwann, patchy destruction of myelin sheaths, and active degeneration of axis cylinders with severe edema of the supporting tissues. Roseman and Aring (16) record the changes previously found in the peripheral nerves, but describe in greater detail the finer histologic changes that appear throughout the central nervous system as well as the focal visceral lesions which they believed were associated with the disease.

Osler remarked that the disease resembled an acute infectious process. Bradford, Bashford, and Wilson believed that they had transmitted the disease experimentally but later retracted this statement. Gilpin, Moersch, and Kernohan reported a large series of cases and believed the disease to be caused by a virus. Sabin and Aring (10) believed that a toxin analogous to that of diphtheria or that of Jamaica ginger poisoning produced the lesions. They considered that a virus was unlikely, as they were unable to reproduce the disease in mice, guinea-pigs, rabbits, or rhesus monkeys by inoculating them with pooled material from fatal human cases.

Various methods of treatment, including large doses of vitamin B and thiamine chloride, have been unsuccessful. Sulfonamides have not aided. Recently Garvey, Jones, and Warren (17) reported six cases that occurred within 16 days after fever therapy had been given for either syphilis or gonorrhea. Of these, three patients had received sulfonamides. Treatment is symptomatic and should include the use of the mechanical respirator and suction apparatus at the earliest suggestion of respiratory distress. While the patient is in the respirator, the internal jugular vein is employed for intravenous therapy (12). Splints, plaster, and physiotherapy—in the form of heat, massage, active and passive exercise—should be used to prevent contractures and to rehabilitate muscles.

CASE REPORT

The patient, a 20-year-old white apprentice seaman, unmarried, was brought, against his wishes, by ambulance to the sickbay at 2000. His company commander noticed that the patient looked ill and "walked as if he were drunk." He was admitted and attended throughout his course at sickbay by one of us (P. J. F.).

The patient stated that for several hours he had had difficulty in walking, and that the base of his spine and both legs were "numb like they were asleep." He had two close friends who had been in the same company since enlistment

3 months previously. They were with him on a working detail throughout the day of entry. The composite history was derived from the patient and his two friends.

About 10 days before entry the patient had a mild "head cold" which persisted for 1 or 2 days. Four or five days before entry he began to have a mild occasional cough which persisted up to admission. On the morning of the day of entry, the patient told his companions that he had a slight headache and felt tired. He lay on a bench for an hour or two. This was the first time, to his friends' knowledge, that he had done this on a working detail. Later the patient found that he could not climb the ladders to the third deck but had to stop at the second because of "weakness in the legs." The patient went to chow at noon, ate well, but it was noticed that shortly afterward he stumbled and fell down the ladder. He landed upright and did not injure himself. At 1400 the patient stated that he had numbness and tingling up and down both legs and that his legs were unsteady. He continued to work until 1600 but with increasing difficulty in walking. At that time his friends noticed that he was walking on a rather wide base. At 1630 the patient fell while climbing the ladder to the first deck and stated that he had difficulty in climbing because his legs were numb and he had no sense of position. Between 1630 and 1900 his friends noticed that the patient was "having trouble walking" and they thought he was pretending to be drunk. He did not go to evening chow, saying that he felt ill, and he fell asleep on a bench.

At 1900 the patient stated that his back felt sleepy "as if there were needles in it." He attempted to put up his hammock but had to ask for assistance. He was unable to pull himself into his hammock and he felt some numbness and tingling of the fingertips. His friends noticed that the patient's voice was changing and seemed "husky and mechanical." About this time he began to complain of slight pain in the ears, jaw, and neck. He was sent to the sickbay under protest, and he insisted that he felt well except for his "legs being asleep" and the feeling that he was "walking on something soft." He also stated that he had "no confidence in his knees." On admission he did not have headache, nausea, vomiting, stiff neck, dizziness, sore throat, cough, chest pains, chills, sweats, fever, gastro-intestinal or genito-urinary symptoms. He felt well but was uneasy at the thought of being brought to the sickbay by ambulance.

Personal history.—The patient had never sought medical attention and had always enjoyed excellent health. He was a high-school graduate and had worked as a coppersmith's apprentice for 2 years prior to enlistment, 3 months before entry.

Physical examination.—The patient was a well developed, well nourished, husky young man, with apprehensive facies. He appeared definitely ill. He was oriented, rational, cooperative, and showed no clouding of the sensorium, but there was a suggestion of hypo-active responses. Examination of the head revealed only mild acne of the face and a hyperemic pharynx. The neck showed palpable, tender, shotty cervical lymph nodes but no stiffness. Supraclavicular and infraclavicular regions showed a few maculopapular erythematous lesions. Heart and lungs were normal. The abdomen, genitalia, and extremities were normal except for neurologic signs.

Neurologic examination.—The pupils were equal, round, and regular, and reacted well to light and accommodation; there was no nystagmus; the ocular muscles were intact. Facial, lingual, palatal, shoulder, and trunk movements were all within normal limits. The arms showed hypo-activity of reflexes and generalized weakness of all muscles, although there were no discrete muscle groups involved. The patient dressed and undressed with difficulty. He was

slow, and slightly ataxic in moving his arms but had no tremors. The legs showed greatly diminished ankle and knee jerks which only rarely could be elicited by reinforcement. Abdominal reflexes were decreased. There was marked variance in pin-prick differentiation of the two legs. The right leg showed segmental hypesthesia and inability to differentiate sharp from dull pin prick. The left leg appeared relatively normal, although there were a few small areas of hyperesthesia. The reaction to the Romberg test was questionable, with only a slight swaying from side to side. The patient had a weaving type of gait suggestive of moderate drunkenness with slight lateral swaying. The temperature was 99.6° F.; pulse 82; respirations were 20.

A neuropsychiatric consultant found a general hypo-activity, no reliable focal signs, but changing sensory perception in the legs. Frequently within a few seconds, the patient would give conflicting and often contradictory statements regarding his perception of sharp and dull pin-prick and pressure sensations.

Tentative diagnosis.—Because of the general apathy and hypo-activity, because of an admission of discontent with Navy life and daydreaming, and the bizarre neurologic symptoms in the legs, the neuropsychiatrist made a tentative diagnosis of functional disease with the suggestion that the signs and symptoms were hysterical, and that the patient be kept overnight for observation.

Course.—The patient was put to bed in the sickbay at 2200 the evening of entry. At 0400 the next morning, he awakened and stated that he could not swallow and felt "a ball in this throat." Examination showed that the patient was able to swallow and seemed unchanged from his condition at entry. At 0700 he complained of hoarseness, inability to swallow, difficulty in speaking, and he vomited for the first time. Examination showed that the patient could not stand, hold the trunk erect, or extend his arms. He was pallid, drowsy, could speak only in a whisper, and had facial diplegia. He was transferred to a Naval hospital with a clinical diagnosis of infectious polyneuritis (Guillain-Barré syndrome).

On arrival at the hospital the patient was cyanotic, in shock, showed râles in both lung fields, and appeared to be dying. Despite oxygen, stimulants, and treatment for shock, respiratory embarrassment increased, the pulse rate dropped to 56 per minute, and the patient failed rapidly. Death occurred as a result of respiratory failure at 1215, approximately 24 hours after the onset of difficulty in walking.

Laboratory tests.—Because the patient was in an observation dispensary ward overnight and arrived at the hospital in a dying condition, laboratory tests could not be made before death occurred.

Postmortem laboratory tests.—Blood culture (heart's blood): There was no growth after 8 days' incubation.

Cisternal puncture: The fluid was slightly opalescent; the cell count was 20 lymphocytes per cubic millimeter; the total protein was 200 mg. per 100 cc.; the sugar content was 20 mg. per 100 cc.

Autopsy.—Autopsy was performed by one of us (H. W.). The body had been well developed, thin but well nourished; rigor mortis was present in average degree, and postmortem lividity discolored the posterior skin surfaces. There was no unusual degree of cyanosis of the face or lips. No significant external lesions were present.

The venules of the body wall were distended with dark red blood. The examination of the body cavities revealed only two abnormalities, moderate enlargement of the spleen, and petechiae of the epicardium.

The heart muscle was firm and the left ventricle was contracted. There were no cardiac lesions except the epicardial petechiae. A few yellow foci were present in the aortic intima.

The lungs were increased in weight and the tissue was moist; however, crepitation could be elicited throughout all lobes, except for foci of collapse along the posterior margins of the lower lobes. Frothy fluid was present in the large and small bronchi. The trachea was free of obstruction. There was no evidence of pulmonary embolism.

The spleen was twice the normal size, with moist, dark red hyperplastic pulp, and the malpighian corpuscles were prominent. The gastro-intestinal tract, liver, biliary tract, pancreas, adrenal glands, kidneys, bladder, and prostate gland contained no other abnormalities than engorgement with blood.

The brain stem and the spinal cord were less firm than is usual, and the fine blood vessels of the pia-arachnoid were prominent. The tissue was moist and sticky, and the cut surface bulged, especially in the caudal segments of the cord, where a few red foci were present on the freshly cut surfaces. The cut surfaces of the cerebral hemispheres and the cerebellum were of normal consistency, but the fine blood vessels were dilated, as in the pia-arachnoid. The ventricular system appeared normal. No meningeal or ependymal exudate or hemorrhage was present. The gross architecture of the brain and the spinal cord was unaltered. There were no abnormalities of the pituitary gland and the pineal body.

Provisional diagnosis at autopsy: Acute myelo-encephalitis.

Microscopic observations: Sections were made of the heart, lungs, liver, kidneys, brain, and spinal cord. Only the abnormal findings are listed. The capillaries in all tissues were engorged with blood.

Lungs: Areas of atelectasis and emphysema, and areas of intra-alveolar hemorrhage were indiscriminately distributed. A few bronchioles contained an acute inflammatory exudate, with similar reaction in their walls.

Liver: In one large portal area there was dense infiltration with lymphocytes and neutrophilic polymorphonuclear leukocytes. No primary liver cell necrosis was present.

Spinal cord and brain: Sections from representative segments of the cord, the brain stem, and the cerebrum were made. Engorgement of capillaries with blood, and edema were found in all sections. The criteria for edema were looseness of tissue, not accounted for by shrinkage, and acidophilic coagulum in the tissues, found especially around veins and capillaries in the cerebrum and the brain stem. In two sections of the pons, a few cells similar to lymphocytes were collected around single large capillaries. In a section of spinal cord from the dorsolumbar region, a few cells which resembled lymphocytes were clustered around a small venule posterior to the central canal. There were no perivascular hemorrhages. A few anterior and posterior nerve roots, attached to sections of the spinal cord, showed no lesions.

Anatomic diagnosis.—A diagnosis was made of acute generalized toxemia, with death as a result of combined respiratory and circulatory failure.

INTERPRETATION OF AUTOPSY FINDINGS

The lesions do not fit the description of any disease. The hyperplastic splenic pulp, the inflammatory focus in the liver, the slight inflammatory foci in the central nervous system, and the edema of the cord and brain—all indicate the presence of severe toxemia. The vascular engorgement, epicardial petechiae, and pulmonary engorgement are characteristic of acute respiratory and circulatory failure.

The foci of bronchiolitis are considered incidental to the respiratory failure.

Lack of specific histologic change in the central nervous system and nerve roots is to be expected in such a rapidly overwhelming process which led to death in one day after onset of signs of the disease. Peripheral nerves, particularly of the lower extremities, should be examined in all cases of acute ascending paralysis.

DIFFERENTIAL DIAGNOSIS

The disease most likely to be confused with infectious polyneuritis is acute, infectious anterior poliomyelitis with ascending paralysis, which was said to occur 32 times in a series of 868 epidemic cases of poliomyelitis reviewed by Wickman (18), although at that time the syndrome of Guillain-Barré was not recognized and it cannot be determined how many of these cases might have been infectious polyneuritis (3).

The points of dissimilarity (3) are these:

1. Poliomyelitis is primarily a disease of the summer months.
2. It tends to be epidemic.
3. Poliomyelitis has a slow progressive onset.
4. Muscle tenderness is present but there are no distinct objective sensory changes (19). The paralyzes of poliomyelitis are segmental, irregular, often unilateral, limited to muscle groups, and rarely ascending.
5. The cerebrospinal fluid shows a moderate proportionate increase of both protein and cells; the cells are polymorphonuclear leukocytes in the first few hours, followed later by lymphocytes, averaging about 100 per cubic centimeter. Further paralytic involvement typically does not occur in poliomyelitis after 2 or 3 weeks (19). Pathologic examination reveals the specific anterior horn cell degeneration of poliomyelitis, described by Sabin (20).

Recently Jaffe and Freeman (4) have reviewed cases of acute necrotic myelitis which may give an ascending paralysis, with death occurring as early as five days (26) after onset. Generally there is abrupt onset of flaccid paralysis with complete sensory loss from the start, a definite level of involvement with progressive ascent of the disease to its inevitable fatality. Usually the cerebrospinal fluid shows increase of cell count and protein; occasionally both are normal; and rarely, dissociation of cell count and protein may take place. A specific pathologic pattern of necrosis or softening of the gray and white matter of the cord with thrombosed or hyperplastic intramedullary vessels is seen.

Rarely, an epidural abscess in the cervical region may give rise to an ascending paralysis. Because of the excellent results obtained by laminectomy and drainage of the abscess (21), this possibility should be kept in mind. The diagnosis should be suggested, as in the major-

ity of cases there is a history of an acute infection, such as chronic furunculosis, an abscess, otitis media, cellulitis, or a history of the occurrence of trauma about a month prior to the onset of the symptoms (22). Most important is the progressive development of localized cervical pain and tenderness, and frequently referred or radicular pain is present. Because the lesion is usually an osteomyelitis of the vertebral body or is metastatic to the epidural space there will be the usual local and systemic signs of infection. In about a week after the appearance of back pain there will appear evidence of neurologic lesions. These lesions may produce a sudden flaccid paralysis with only slight sensory involvement, although more frequently a paraplegia of the flaccid type with paresthesias develops slowly over the course of a few days. Occasionally the level of sensory involvement may ascend or descend depending on the migration of pus in the epidural space. Abnormal fluid in the epidural space and spinal fluid changes (or either of these) with a subarachnoid block should be diagnostic.

There are other less likely possibilities to be considered, such as paralysis resulting from diphtheria, botulism, tick (23) and mussel (24) poisonings, neuromyelitis optica (25), and encephalomyelitis (12), but no evidence was found in the clinical history and examination, in the subsequent interrogation of the patient's friends, or at autopsy to suggest any of these possibilities.

SUMMARY

A case is presented of rapidly ascending paralysis, characterized by cyto-albumin dissociation of the cerebrospinal fluid, and negligible visceral and central nervous system lesions. It is believed that this case represents an example of the Guillain-Barré syndrome, in which death occurred from respiratory paralysis before observable histologic lesions developed in the central nervous system.

Reports of increased mortality suggest that this disease has become more virulent during the present war.

REFERENCES

1. LANDRY, O.: Note sur la paralysie ascendante aiguë. *Gaz. hebd. de med.* 6: 472, July 9; 486, August 5, 1859.
2. GUILLAIN, G.; BARRÉ, J. A.; and STROHL, A.: Sur un syndrome de radiculonevrite avec hyperalbuminose du liquide cephalorachidien sans reaction cellulaire. *Bull. et mém. Soc. méd. d. hôp. de Paris* 40: 1462-1470, October 13, 1916.
3. DE SANCTIS, A. G., and GREEN, M.: Acute infectious polyneuritis; diagnostic problem during poliomyelitis epidemic. *J.A.M.A.* 118: 1445-1447, April 25, 1942.
4. JAFFE, D., and FREEMAN, W.: Spinal necrosis and softening of obscure origin; necrotic myelitis versus myelomalacia; review of literature and clinicopathologic case studies. *Arch. Neurol. & Psychiat.* 49: 683-707, May 1943.

5. KENNEDY, F.: Infective neuronitis. *Arch. Neurol. & Psychiat.* 2: 621-627, December 1919.
6. DE JONG, R. N.: Acute ascending paralysis; clinical and pathologic report on cases with fatal termination. *J.A.M.A.* 115: 1951-1955, December 7, 1940.
7. OSLER, W.: *The Principles and Practice of Medicine*. D. Appleton & Co., New York, 1892. pp. 83-86.
8. LAURENS, A.: Des diplegies faciales au cours des polynevrites. *Paris Thesis* 210, 1908.
9. FOX, M. J., and O'CONNOR, R. D.: Infectious neuronitis; review of literature and presentation of 4 cases. *Arch. Int. Med.* 69: 58-66, January 1942.
10. SABIN, A. B., and ARING, C. D.: Visceral lesions in infectious polyneuritis (infectious neuronitis, acute polyneuritis with facial diplegia; Guillain-Barré syndrome; Landry's paralysis). *Am. J. Path.* 17: 469-482, July 1941.
11. CASAMAJOR, L.: Acute ascending paralysis among troops; pathologic findings. *Arch. Neurol. & Psychiat.* 2: 605-620, December 1919.
12. FORSTER, F. M.; BROWN, M.; and MERRITT, H. H.: Polyneuritis with facial diplegia; clinical study. *New England J. Med.* 225: 51-56, July 10, 1941.
13. RUSSELL, W. O., and MOORE, W. L.: Permanent damage to nervous system following attack of polyradiculoneuritis (Guillain-Barré syndrome). *Arch. Neurol. & Psychiat.* 49: 895-903, June 1943.
14. BRADFORD, J. R.; BASHFORD, E. F.; and WILSON, J. A.: Acute infective polyneuritis. *Quart. J. Med.* 12: 88, October 1918; 126, January 1919.
15. GILPIN, S. F.; MOERSCH, F. P.; and KERNOHAN, J. W.: Polyneuritis; clinical and pathological study of special group of cases frequently referred to as instances of neuronitis. *Arch. Neurol. & Psychiat.* 35: 937-963, May 1936.
16. ROSEMAN, E., and ARING, C. D.: Infectious polyneuritis; infectious neuronitis, acute polyneuritis with facial diplegia, Guillain-Barré syndrome, Landry's paralysis, etc. *Medicine* 20: 463-494, December 1941.
17. GARVEY, P. H.; JONES, N.; and WARREN, S. L.: Polyradiculoneuritis (Guillain-Barré syndrome). *J.A.M.A.* 115: 1955-1959, December 7, 1940.
18. WICKMAN, I.: Acute poliomyelitis, Monograph 16. *Nervous & Mental Disease Publishing Co.*, New York, 1913.
19. TOOMEY, J. A.: Diagnosis of poliomyelitis. *J.A.M.A.* 117: 269-273, July 26, 1941.
20. SABIN, A. B.: Pathology and pathogenesis of human poliomyelitis. *J. A. M. A.* 120: 506-511, October 17, 1942.
21. ECHOLS, D. H.: Emergency laminectomy for acute epidural abscess of spinal canal; report of 4 cases with recovery in 3. *Surgery* 10: 287-295, August 1941.
22. BOHARAS, S., and KOSKOFF, Y. D.: Early diagnosis of acute spinal epidural abscess; report of illustrative case. *J. A. M. A.* 117: 1085-1088, September 27, 1941.
23. ABBOTT, K. H.: Tick paralysis; review. *Proc. Staff Meet., Mayo Clin.* 18: 39-45, February 10, 1943; 59-64, February 24, 1943.
24. SOMMER, H., and MEYER, K. F.: Mussel poisoning. *Hygeia* 19: 620, August 1941.
25. PUTNAM, T. J., and FORSTER, F. M.: Neuromyelitis optica; its relation to multiple sclerosis. *Tr. Am. Neurol. A.* 68: 20-25, June 1942.
26. DRAGANESCU, S., and LUPASCU, G.: Syndrome of Landry's paralysis in course of acute necrotic myelitis. *Rev. stiint. med.* 29: 210-226, March 1940, quoted by Jaffe and Freeman (4).

INFECTIOUS POLYNEURITIS

A REPORT OF FOUR CASES

A. WARREN STEARNS
Captain (MC) U. S. N. R.

and

HERBERT I. HARRIS
Lieutenant Commander (MC) U. S. N. R.

Infectious polyneuritis is a dramatic and in most cases an alarming disease. The rapid spread of the paralysis, at times involving the nerves of the chest and diaphragm and consequently requiring the use of a respirator, is a disturbing experience for the physician who meets this disease for the first time.

The disease has been given many names. Landry has been credited with the first description of infectious polyneuritis and many still refer to the disorder as Landry's ascending paralysis. Landry's original case report, however, describes the patient as an elderly man who had been partly disabled for a year and a half prior to the onset of the acute ascending paralysis. Dementia paralytica was so prevalent at that time that it would seem likely that syphilis may have contributed in Landry's case.

Guillain and Barré described the disease to the satisfaction of many, but other terms, such as "infectious neuronitis" and "acute polyneuritis with facial diplegia" have been used. Present day writers seem to favor the term "infectious polyneuritis" and it is to be hoped that this designation will be permanently accepted.

The injury to nerve tissue which occurs in infectious polyneuritis is confined to the spinal cord, the nerve roots, and the peripheral nerves. Sabin and Aring found peculiar changes in the splanchnic ganglia of the vegetative nervous system in one case. When the signs and symptoms of the disorder are examined closely, they will be found to be explainable in every case on the basis of lesions in the peripheral, somatic or cranial nerves.

The facial nerve has been found affected in so many of the cases reported that the expression "facial diplegia" frequently has been used to qualify the name of the disease. The oculomotor, trigeminal, glossopharyngeal and hypoglossal nerves are also involved by the disease process with moderate frequency. The ninth and twelfth nerve

involvement doubtless contributes to the difficulties in speech and swallowing that patients with this disorder experience.

The prognosis of the disease increases in gravity with age. Death from this disease in children is so rare that Aring and Sabin published a case report of one child who died of it.

Within the last two years there have been four cases of infectious polyneuritis at the United States Naval Hospital at Chelsea. Inasmuch as Merritt collected only 26 cases at the Boston City Hospital in 10 years, the disease seems of sufficient rarity to warrant reporting.

CASE REPORTS

Case 1.—A fireman, third class, age 18, was admitted to the eye service on 25 May 1942, because of diplopia. The temperature was 99.6° F.; pulse rate 100; respirations 18; leukocyte count 11,700. The patient was not acutely ill. He stated that he had recently had a severe infection of the nose and throat.

Examination showed the voice to be nasal in quality; the palate did not rise on phonation. There was a slight diplopia. Knee jerks were present and equal. There was a purulent discharge from the sinuses. The patient was seen in consultation by the neurologic service. A diagnosis of multiple neuritis was made. The patient was transferred to that service because of increasing symptoms. Knee jerks and ankle jerks disappeared. Difficulty in speaking and swallowing developed. There was weakness in the arms and legs, and the patient complained of a burning and prickling in his hands and feet, although there was no loss of sensation to touch and pain. A diagnosis of myasthenia gravis was suggested but ruled out by appropriate tests. A diagnosis of lead poisoning was also eliminated. There was a transitory delirium part of one day. At no time after admission was the temperature elevated, and the highest white count was 11,700. Lumbar puncture on 1 June showed a total protein of 79 mg. On 21 June there were no cells and total protein was 63 mg.; globulin was slightly increased and the gold-sol reaction was normal. On 1 August the total protein was 90 mg.; globulin increased; there were no cells, and the gold sol was 0012221000. On 11 August the total protein was 95 mg.; globulin was slightly increased; and gold sol was 0122310000. There was gradual improvement and by September the ankle jerks and knee jerks were present.

The patient was free of neurologic symptoms but had become somewhat asthenic and discouraged. A survey was recommended and he was discharged with a diagnosis of multiple neuritis. By letter in March 1944, he states that there has been no return of the neurologic symptoms, although he still makes many ill-defined complaints. He is working in a defense plant.

Case 2.—A lieutenant (junior grade), age 28, was seen in consultation on 25 March 1943, because of a sore throat of a week's duration, ptosis, and tingling of the hands and feet for 24 hours. The knee jerks and ankle jerks were absent. The temperature was 98° F., pulse 60, respirations 15. Symptoms progressed rapidly. The patient became entirely helpless, could not move his arms or legs; his speech was barely intelligible, and he had great difficulty in swallowing. He complained of a sense of compression on the chest. The white count was 12,500. The spinal fluid examination on 29 March showed total protein 147 mg.; white cells 2; globulin slightly increased. He remained in what seemed a critical condition for a few days but on 6 April began to improve. On 13 April

the knee jerks had returned but ankle jerks were still absent. On 16 April the knee jerks and ankle jerks were both present. The total protein was 111 mg., gold sol 112330000. By 1 May the patient was entirely free from symptoms and was returned to duty. On 1 June he returned for spinal fluid examination and there was still 125 mg. of total protein, at which time he was symptomless.

Case 3.—An aviation cadet, age 18, gave a history of having had a severe cold for some time prior to admission. On 6 February 1944, his parents noticed that he seemed cold and shivering. The next day while playing basketball, he seemed to miss frequently and did not feel well. That night he was sleepy. The next morning he was worse and had a hard time walking. He could not control his legs. He went to the sickbay and was seeing double. On admission, he was drowsy and was put to bed, and for the first few days he complained of stiffness of the neck, of difficulty in passing urine, and that his hands and feet felt as if they were asleep; there was a burning and prickling sensation in them. His legs and arms were also weak. The next day he had some difficulty in speaking and eating. He was admitted to the hospital on 10 February and at that time was markedly enfeebled. Speech was barely intelligible; he had difficulty in swallowing, and had diplopia. There was a bilateral facial palsy. Knee jerks and ankle jerks were absent. There was a respiratory difficulty, and the grasp was weak. The patient could not stand alone. The temperature was 98.6° F., pulse, 80, respiration, 20; white count 9,300, later 8,600. Spinal fluid was clear and showed a total protein of 57 mg.; gold sol was 0012210000; there was no increase in cell count, and the pressure was 170. The sedimentation rate was 15 minutes, 5; 30 minutes, 11; 45 minutes, 18; 60 minutes, 20. The condition remained critical for several days. The patient was put in a respirator.

Temperature was normal except for one reading on the second day of 100° F. An electroencephalogram, taken primarily for academic interest, was considered normal. None of the patterns encountered in cases of encephalitis was in evidence. After 3 days the patient showed some improvement and subsequently improvement was rapid and continuous. Knee jerks and ankle jerks returned and were equal. On 14 March the patient had been entirely free of symptoms for one week and was returned to duty entirely well.

Case 4.—The patient, age 19 years, gave a history of excellent health except for a recent severe cold from which he had not completely recovered. He states that on 4 February 1944, his legs felt like rubber and he could not ascend the stairs. He had to be taken to school for five days on account of weakness in his legs. He had fallen some time previously, when a tentative diagnosis was made of peripheral neuritis; it was believed that sciatic injury had occurred. The patient was admitted to the hospital on 4 February 1944 with a temperature of 98° F., pulse 100, and respirations 20. Symptoms developed rapidly during the next few days. The patient became incontinent and was somewhat delirious for one day. He had great weakness in his arms and legs and marked difficulty in swallowing and speaking, with some respiratory embarrassment requiring a respirator. Spinal fluid upon admission showed a total protein of 205 mg.; 80 cells; the white cell count was between 15,400 and 8,300. There was tingling and weakness of the hands and feet. An electroencephalogram at this time showed none of the changes encountered in cases of encephalitis. On 12 February, 8 days after admission, the patient began to improve. On the 14th he developed what was called a hypostatic pneumonia. On the 24th he was well along in convalescence and at this writing is almost free of symptoms. He is still slightly asthenic and his arms and legs are still somewhat weak. He has had no temperature at any time. The sedimentation rate on 15 February was for 15

minutes, 16; 30 minutes, 22; 45 minutes, 23; and 60 minutes, 24. On 8 March knee and ankle jerks were still absent. Neurologic symptoms have cleared but the patient is still somewhat feeble and does not gain weight.

COMMENT

The cases here described present striking similarities: All showed a history of previous upper respiratory tract infection; all showed rapid onset. Although there was an ascending paralysis, there were many symptoms suggesting that the whole peripheral nervous system was affected almost immediately. The patients were afebrile and the white count was not consistently elevated. The spinal fluid showed increased protein and in three cases there was no cellular increase. Difficulties with speech and swallowing were particularly prominent. Most of the peripheral nerves in the body were involved. These patients did not present frank sensory and motor disturbances as seen in lead and alcoholic paralyses. The sensory symptoms were less marked than the motor symptoms. The history and course in each case was similar. Whereas the symptoms appeared serious, the outcome proved to be favorable.

It is possible that the use of the respirator was instrumental in tiding one patient over his most acute stage. In any case in which the signs and symptoms described are found, it would appear to be wise to use a respirator if one is available.



CORNEAL VASCULARIZATION AND NUTRITION

The degree of corneal vascularity was determined in about 4,000 RAF personnel. The effect of supplementing the diet with riboflavin and other pure vitamins and highly nutritious foodstuffs was examined.

Many subjects receiving excellent dietaries had blood-vessels on the cornea, and subjects with much corneal vascularity did not always improve when the diet was supplemented. Hence vascularity of the cornea is not necessarily evidence of deficiency in the diet.

On the other hand, it was regularly found that there was little corneal vascularity where the food was good and more where food was less satisfactory. The average degree of corneal vascularity in a group of subjects is therefore a reliable index of their general state of nutrition.

Riboflavin is not the only nutrient concerned in the prevention of corneal vascularisation. Indeed these experiments suggest that other factors present in fruits and vegetables influence this condition more than riboflavin.—LYLE, T. K.; MACRAE, T. F.; and GARDINER, P. A.: Corneal vascularisation in nutritional deficiency. *Lancet* 1: 393-395, March 25, 1944.

DERMATOLOGIC PRACTICE IN THE SOUTH PACIFIC

A REVIEW OF 1,500 CASES

CHARLES T. BINGHAM

Lieutenant Commander (MC) U. S. N. R.

and

RONALD L. MACKE

Pharmacist's Mate, second class U. S. N. R.

It has been said that the three major medical conditions which affect military personnel in the tropics are malaria, dysentery, and skin infections. During the 13-month period ending 24 September 1943 there was the opportunity to observe and treat 1,500 patients with skin disorders. The patients were seen in the skin clinic of a large mobile hospital situated in a temperate zone. This hospital served as one of the evacuation centers for the entire South Pacific area. Most of the men had been shipped out from combat areas in the Solomon Islands. A few had spent little time in the tropics or had only passed through the tropics. All, however, had acquired skin lesions and needed dermatologic care.

During the same 13-month period covered by this review, approximately 10 percent of all entries in this hospital were of this category. It is impossible to be certain about this figure, because in many of the minor cases tabulated, patients either came for treatment as outpatients or had already been hospitalized for other conditions; otherwise the dermatitis may never have come to our attention. Ten percent, however, is probably a fair estimate of the prevalence of skin disease among all casualties at this hospital.

The cases are divided into five major etiologic groups which are listed and discussed in the following order: Parasitic infections of the skin; fungus infections of the skin; bacterial infections of the skin; virus infections of the skin; and irritations of the skin. The following table summarizes the conditions seen, showing the number of cases of each type:

Tabulation of 1,500 cases of skin disease in the South Pacific

	Number of cases	Number of cases in group	Percentage of total
Parasitic infections of the skin:			
Scabies.....	85		
Pediculosis corporis.....	4		
Total.....		89	5.9
Fungus infections of the skin:			
Dermatophytosis, feet (also includes dermato- phytids of hands and body).....	273		
Tinea cruris.....	68		
Tinea circinata.....	34		
Tinea versicolor.....	13		
Total.....		388	25.9
Bacterial infections of the skin:			
Acne vulgaris.....	105		
Skin ulcers (also includes tropical sores and ecthyma).....	74		
Furuncle, multiple.....	49		
Folliculitis.....	44		
Impetigo contagiosa.....	39		
Bites, infected.....	38		
Cellulitis.....	24		
Sycosis vulgaris.....	13		
Pyoderma (includes dermatitis repens).....	10		
Acne rosacea.....	6		
Total.....		402	26.8
Virus infections of the skin:			
Verruca vulgaris.....	44		
Warts, plantar.....	41		
Herpes simplex.....	6		
Herpes zoster.....	3		
Total.....		94	6.2
Irritations of the skin:			
A. Dermatitis:			
Unclassified.....	93		
Eczematoid.....	83		
Seborrheic.....	76		
Venenata.....	34		
Vesicular of hands.....	27		
Medicamentosa.....	17		
Contact.....	17		
Toxic.....	12		
Neurodermatitis.....	9		
Herpetiformis.....	2		
Total.....		370	24.7
B. Functional dermatoses:			
Prickly heat.....	35		
Dry skin (ichthyosis).....	17		
Dyshidrosis.....	16		
Pruritus ani.....	9		
Total.....		77	5.1

Tabulation of 1,500 cases of skin disease in the South Pacific—Continued

	Number of cases	Number of cases in group	Percentage of total
Irritations of the skin—Continued.			
C. Allergic dermatoses:			
Urticaria.....	27		
Atopic dermatitis.....	5		
Angioneurotic edema.....	2		
Total.....		34	2.3
D. Dermatoses of unknown etiology:			
Alopecia areata.....	10		
Psoriasis.....	9		
Pityriasis rosea.....	4		
Erythema multiforme.....	3		
Erythema nodosum.....	2		
Lichen planus.....	2		
Lupus erythematosus.....	1		
Total.....		31	2.1
E. Traumatic dermatosis:			
Calluses (corns).....	15		
Total.....		15	1.0
Total.....		1,500	100.0

PARASITIC INFECTIONS OF THE SKIN

Scabies can easily be recognized by the distribution of the lesions, which are small, frequently excoriated papules scattered over the genitalia, around the buttocks, groins, lower part of the abdomen and upper part of the thighs, in the axillae, and on the wrists and finger webs.

Treatment consists of from 5-percent to 15-percent sulfur ointment in all cases. The condition will not improve without specific treatment. Many cases had persisted for several months and severe secondary infection had developed because proper and early diagnosis had not been made. Sulfur dermatitis was rarely seen. All patients were cautioned not to use the sulfur ointment more than from 5 to 7 days. Most of these cases of scabies were acquired after the men left the tropics.

FUNGUS INFECTIONS OF THE SKIN

Dermatophytosis in all its aspects has been a serious problem. This is to be expected in a moist tropical climate especially when personal hygiene is difficult to maintain. Most of the 388 tabulated cases had been completely intractable under treatment in forward tropical areas, even as sickbay or hospital patients. In mild cases the patients responded to rest and cleanliness and could be returned to duty.

They could be kept free of infection except when battle and jungle conditions made any attempt to bathe or change to clean dry clothing impossible.

The patients whom we saw presented the most severe and stubborn cases of fungus disease of the skin. They were patients who had become sensitive to fungus. Most of them had dermatophytids of the hands. Many of the cases of dermatophytosis were generalized and complicated by secondary infection. The patients had been hospitalized for many weeks, and required so much nursing when badly infected that they were as much of a problem as a wounded man with a compound fracture of the leg. Because of this, no man should be sent into the tropics who is known to be sensitive to fungus infection of the feet. He will never be able to do his job for any length of time in the jungle, in combat, or in the fireroom of a ship. If asthmatic persons or bedwetters are not wanted in military service, a man who has had one severe attack of athlete's foot should also be rejected.

The diagnosis of an underlying fungus infection is relatively unimportant, because strong antiparasitic remedies are more dangerous than useful. The important point to remember is that as in all cases of dermatitis, secondary infection must be eliminated first. This calls for constant wet compresses. Potassium permanganate, 1:5,000, was used chiefly. Saturated solution of boric acid or magnesium sulfate was more efficacious in other cases. Sulfathiazole by mouth was helpful in cases with true cellulitis or lymphadenitis, but it is a poor drug to apply locally; it seems to have no effect on the fungus itself and it not infrequently leads to sensitization and a generalized maculopapular eruption. Inquiry regarding previous use of a sulfa drug and tolerance to it must always be made before a sulfonamide is used.

Tinea infections of the trunk or groins cleared rapidly in a temperate climate, mostly through bathing and cleanliness. Although many lesions were extensive, none of the patients was disabled by infections. It was noted that athlete's foot was rare. The patients had some local immunity.

BACTERIAL INFECTIONS OF THE SKIN

Acne vulgaris becomes a distressing disease under tropical conditions. Many young men with oily skin and slight tendency to acne of the back continued at work in the tropics until their backs were covered with pustules, furuncles, and abscesses. The faces of others will be permanently and badly scarred from the exacerbation of pre-existing acne. No man who shows any marked evidence of acne scarring of the face, shoulders, chest, or back should be sent to tropical duty.

He at once becomes a nuisance to himself and his medical officer and soon becomes a nursing problem. This should be emphasized more strongly to all medical officers who are engaged in recruiting duty. It should be remembered also that disfigurement of the face is a psychic hazard and disregard of a man's "pimples" may destroy the efficiency of an otherwise able-bodied citizen. When manpower at home is so vital, the recruiting officer should be alert to keep all persons with potentially severe acne in civilian life. At least three-fourths of the 105 cases reported were unfit for tropical duty and probably half of them should not have been in the armed forces.

Ulcers of the skin were seen in 74 cases. A few resembled the small multiple lesions of ecthyma, but the majority were the large punched out, dirty ulcers commonly spoken of as tropical sores. They occurred almost entirely on the extremities and mostly on the lower part of the legs. The lesions were usually multiple. The true etiology of these ulcers is obscure, but poor local resistance brought on by prolonged duty in the tropics, underlying malaria, lack of cleanliness, increased sweating, and overtreatment of early lesions—all were contributing causes. Many cases probably had their origin in infected mosquito bites or tiny abrasions which became ecthymatous. In all cases there were negative reactions to the Kahn test. No specific organism could be cultured. All patients responded well to the simplest measures: Rest, elevation, constant saline compresses, daily removal of all crusts and slough. A pressure dressing helped when all signs of surrounding cellulitis and edema had subsided. The sulfonamides were useful in the smaller ecthymatous lesions but not necessary in the large, deep ulcers. After the crater had filled in, those more than 2 centimeters in diameter occasionally required skin-grafting.

Regarding the remainder of the group of 402 bacterial skin infections, sulfathiazole by mouth did not prove efficacious. Patients with severe pustular acne or furunculosis who were given this drug orally improved no more than those who were treated only locally. The powder of sulfanilamide is of value topically in impetigo and sycosis vulgaris, and in ecthyma if all the crusts are first removed. Men with poor skin resistance are constantly hampered by multiple furuncles or infected insect bites. They are of little use in the tropics, and if a man is markedly hypersensitive to insect bites, he had better not be sent to the tropics.

VIRUS INFECTIONS OF THE SKIN

Warts still seem to be a nuisance, especially when they occur on the sole of the foot. Of 85 patients seeking treatment, 41, almost half,

had the plantar type of wart. Warts should not be treated casually. There are too many instances of recurrence in the scar from inadequate or careless removal. Injection of bismuth subsalicylate in oil, 1 cc. (.13 gm.) intramuscularly, once a week for 6 to 8 weeks, was helpful in the cure of plantar warts, especially when these were multiple. A plantar wart is often disabling. It should serve as a cause for rejection of a recruit until it has been removed.

Herpes simplex is relatively common in malaria but not many cases were severe enough to warrant treatment in the skin department. This is the reason for the low incidence, 6 cases, reported in the tabulation.

IRRITATIONS OF THE SKIN

Dermatitis.—Under the term dermatitis 370 cases are listed. Many of these cases could not be well sorted, because when the patients were first seen at this hospital, they had had the skin lesions for some time. A few cases had progressed to the advanced stage of exfoliative dermatitis. It was often impossible to say whether the initial appearance was as a dermatitis venenata, fungus infection, or contact dermatitis.

There were 93 of these cases left unclassified, their etiology obscure; 83 other cases were chronic and eczematoid. They were so diagnosed because of their appearance, but many of them probably originated also as fungus disease or dermatitis venenata. A good many localized eczemas developed when the skin around a wound or injury became irritated by local medication.

Although only 17 cases of dermatitis medicamentosa are listed, many more patients have a history of sensitivity to local remedies. Sulfathiazole ointment is the commonest irritant, and severe generalized maculopapular, morbilliform eruptions, sudden and dramatic in their onset, were not uncommon. Four detailed case reports of sensitivity to topical application of sulfathiazole, taken from this group of 17, have already been submitted for publication. The sensitization is likely to occur if sulfathiazole ointment is applied to eczematoid and chronic lesions. Its use, therefore, should be reserved for the bacterial infections of the skin. If secondary pyogenic infection is superimposed on a chronic dermatitis, sulfanilamide powder or sulfathiazole ointment may be tried to help clear the infection, but the hazard of sensitization to the drug by local application must be remembered and at the slightest sign of dermatitis, treatment must be halted.

Quinine was apparently causative in one severe case of exfoliative dermatitis. Atabrin may have caused one or two other milder cases and it occasionally led to the development of urticaria, but atabrin certainly is not irritating to the skin. It has been used in thousands of cases without untoward results. Hypersensitivity of the skin to

the mercury of tincture of merthiolate and ammoniated mercury ointment was seen in six cases, in one of which a complete exfoliation occurred.

Because the actual irritants in this large group of cases of dermatitis are for the most part not known, treatment may seem haphazard; however, in most cases the specific inciting factor, whatever it was, was present in the tropical islands. The removal of the patient from the tropics, therefore, was tremendously beneficial. Gentle and soothing treatment, ointments for dry skin, and lotions and compresses for weeping areas are, as is usual in all dermatologic practice, the best rules to follow. What is applicable for one patient may not be applicable for another. Never apply any powerful ingredient without inquiring regarding sensitivity to it. This will prevent complications. Many enlisted men are reluctant to warn a medical officer about their skin peculiarities. They think he knows best and will often silently accept his prescription even when they know that the drug prescribed will be harmful.

Sulfur and salicylic acid in combination (4 percent of each in petrolatum) again proved its exceptional usefulness in seborrheic dermatitis of the scalp and elsewhere. Of 76 patients with some type of seborrheic dermatitis, all but 8 or 10 cases cleared rapidly under this treatment alone.

Functional dermatoses.—Prickly heat if at all severe is hard to treat even under the best of conditions. It becomes disabling in the tropics, so that many of the 35 patients had to be evacuated.

Patients with unusually dry skin do well in the tropics but have discomfort as soon as they change to a cooler climate. Most of the 17 patients seen were relieved soon after the application of a simple, bland ointment.

Allergic dermatoses.—Chronic hives or urticaria has been intractable in the tropics. Persons known to have this condition should not be sent overseas, because the stress and strain will initiate disabling attacks. All patients with chronic allergic dermatoses, these comprising the majority, were transferred back to the United States.

Dermatoses of unknown etiology.—One case of erythema nodosum deserves special mention. It was severe and was associated with malaria. When the Plasmodium vivax parasites were identified, atabrin therapy was instituted, and the skin lesions cleared rapidly. The patient subsequently had a recurrence of malaria, and on this occasion developed a psychosis but no further skin disease.

OTHER SKIN LESIONS

Neoplasms are not included in this report as most of them were handled by the surgical service.

Syphilitic lesions are not discussed here because the prevalence of syphilis is only important when considered in relation to the total personnel of the area. The figures are not available to us.

Yaws, pinta, leprosy, and other skin infections usually associated with the tropics were not encountered at this hospital.

COMMENT

One striking fact, apparent from a quick review of this compilation of 1,500 cases of skin disease, is that none of the rare but typically tropical skin diseases was seen. Most of the patients had been on arduous tropical duty under combat conditions. Their skin could not tolerate fungus, bacteria, and plant irritants. They were subject to dermatophytids of hands or body. They could not maintain immunity against the usual presence of bacteria on the skin. A pyogenic infection of the skin could not heal while they remained in the tropics. They were more likely to develop acute dermatitis from a plant allergen than is usual, even though the allergen itself could not often be recognized. The lesions that they presented, however, were the same as those occurring at home in a similar age group. The only unusual lesions were the so-called tropical sores, and these seem to be typical, large ecthymatous ulcers. There is nothing mysterious about skin disease in evacuees from the South Pacific.

CONCLUSION

Dermatologic practice in military personnel from the South Pacific area is largely the same as that encountered in the United States. Dermatologic treatment in the tropics, therefore, must follow the recognized laws of therapy used at home:

1. Treat the patient as a whole. Give him good care and rest.
2. Treat the skin gently.
3. Treat secondary infection first.
4. Before changing treatment, inquire about sensitivity to previous application.

Men subject to bacterial skin infection or unduly sensitive to fungus infection of the feet or to contact dermatitis from plant or other allergens are unsuitable for combat duty, especially in a tropical zone. They should be eliminated in the recruiting offices if possible.

FACTORS IN EFFICIENT MASS BLOOD PROCUREMENT

K. P. A. TAYLOR

Lieutenant Commander (MC) U. S. N. R., Retired

One of many new Army and Navy medical activities is that of mass blood procurement for plasma production. Under direction of the American Red Cross this enterprise utilizes service medical officers in most of its blood donor centers. These physicians supervise the mass collection of blood and act as medical directors of some donor centers.

Second only to the public's interest in creating an adequate plasma pool is its recognition of the need for the most efficient possible disposition of all physicians and nurses, civilian and service alike. Since a wide disparity of method and result was observed in various donor centers, the present study was undertaken to determine the most effective use of primary factors in mass blood procurement.

It should be made clear that for the United States mass blood procurement is still an "infant industry," and that its methods are the object of continued scrutiny and change in many centers intent upon improving or maintaining output. Each center has, moreover, local situations requiring individual adaptations. This survey is therefore not a criticism of the general method of blood procurement or of individual centers. Data submitted in July 1943 by medical directors of 23 eastern and midwestern centers constitute the basis of this investigation.

Primary factors in blood procurement.—Shortage of physicians and the large volume of blood procurement have made of the Red Cross nurse the actual veneselector and therefore the unit of comparison in this study. The problem of the most effective use of doctor and nurse in blood procurement accordingly concerns primarily the most effective use of the nurse, under the physician's supervision. This study is not concerned with the standardized methods of bleeding, beyond emphasizing that a "speed-up" cannot be effected by accelerating the bleeding time to 5 minutes or less, or by hurrying the donor from the bleeding table. These measures bring about an increased rate of syncope and reactions, and an ultimate fall in procurement.

The factors to be considered are: The population served by a center, the number of nurses and physicians required, the number of mobile and center units, the best hours of operation for center and mobile units, the number of bleedings per nurse per week, total hours of bleeding per week, ratio of bleeding per hour to total hours,

bleeding per nurse per total hours, the average number of bleedings per hour per nurse, the average number of hours of work per week, and the most favorable number of "overtime" hours (hours after 5 p. m.) for the center and for mobile units.

Correlation of population with procurement.—The number of bleedings to be expected each week is not a simple fraction of the population served by the center (table 1). The bleeding records of centers cannot therefore be compared on a direct population basis. It was established that the centers in the smallest cities have the highest ratio of bleedings to population, while the largest cities exhibit the lowest figures. The effectiveness of each center is, in fact, in inverse ratio to the size of the population served. The most efficient center, on this basis, is the smallest, Harrisburg, with a population only 110 times its weekly blood procurement rate. New York City, on the other hand, has 1,570 individuals for each weekly blood donation. A curve fitted to a scatter graph of table 1 is a valid expression of diminishing returns. An inescapable inference is that procurement in large cities could be greatly increased by duplicating fixed centers, with each center functioning as its own source of appeal for donors, as cities within a city. Most or all of the cities with ratio of population to procurement in excess of the mean (4.6) should establish additional fixed centers, or divide the present fixed centers. This would apply particularly to cities of population exceeding 850,000.

TABLE 1.—*Cities in order of population, showing inverse ratio of population to procurement (law of diminishing returns). Cities with correlation figures not aligned in ascending scale are above or below the return to be expected on a basis of population.*

Population (000 omitted)	City	Ratio population to pro- curement	Correlation of ratio to population
170	Harrisburg.....	1.1	150
414	Columbus.....	1.6	258
419	Rochester.....	1.9	220
431	Schenectady.....	3.0	143
497	Indianapolis.....	2.4	207
523	Atlanta.....	3.5	149
531	Hartford.....	2.0	265
686	Kansas City.....	2.7	253
790	Milwaukee.....	3.0	296
852	Cincinnati.....	3.4	250
909	Minneapolis.....	5.0	181
965	Buffalo.....	3.8	253
1,181	Washington.....	4.0	295
1,189	Cleveland.....	3.4	349
1,193	Baltimore.....	6.2	176
1,504	St. Louis.....	5.0	300
2,114	Pittsburgh.....	4.6	459
2,554	Detroit.....	5.1	500
2,698	Brooklyn.....	9.6	281
2,715	Boston.....	4.5	603
2,973	Philadelphia.....	5.9	504
4,542	Chicago.....	9.0	504
8,389	New York.....	15.7	540
4.6 mean.			
2.8 standard deviation.			

Additional mobile units are not favored to increase procurement in well-populated districts. Travel time alone in mobile units reduces potential bleeding capacity of doctors and nurses by 50 percent or more. This study emphasizes, in addition, the actual operating superiority of the fixed over the mobile unit. The latter are in fact colossal wasters of professional time, and should not be operated where a fixed center (even a very small one) can be installed.

Comparison on population basis.—Although procurement rates cannot be directly compared on a basis of population, the correlation figures of table 1 indicate cities which exceed or fall below the return to be expected. In the former group are Hartford, Cleveland, Boston, and Philadelphia. These cities are given the over-all rank, respectively of 6, 8, 16 and 17 in total procurement. Hartford, because of low total bleeding hours (minus 27.0 deviation from the mean), the other three, because of relatively large numbers of nurses employed in relation to yield (plus 19.0 deviation), are ranked below other cities in bleeding per nurse per week, though they excel on the basis of yield per population.

Cities with depressed production rates, on this basis, and their final ranking, are Schenectady (19), Atlanta (20), Minneapolis (15), Buffalo (23), Baltimore (21) and Brooklyn (13). The comparatively low procurement of these cities is associated in all (except Buffalo) with an insufficient number of nurses. The mean deviation in nurses of the cities affected is minus 6.6. Procurement could be increased rapidly in these cities by enlarging the bleeding staffs. (Buffalo's deviation is plus 8.5.)

It is not assumed that all factors concerned with blood procurement can be reduced to a mathematical formula. Procurement in a community is a coefficient of appeal and resistance. The positive appeal for donors is standardized and fairly uniform in different cities. The "intangible" appeal, on the other hand, is sharply conditioned by each community. It includes the location, general facilities, degree of comfort and luxury, cleanliness, and atmosphere of a center; the general personal and professional handling of donors, and the effort expended to minimize the number of painful arms and faintings. It is obvious that the reactions of syncope, shock, convulsions, and to a lesser degree, painful, traumatized arms, constitute a definite hazard to the maintenance of a high procurement rate. The British, with two years' more experience in mass donation, have antedated American opinion in correctly evaluating fainting as a major barrier to high procurement (1) (2). Very serious efforts have been made in England to reduce the incidence of fainting.

There is little doubt that the relatively low procurement rank of some of our cities is due to deficiencies in the cited intangible appeal, and particularly to indifference to fainting and to painful

arms. A "bleed them all" (or nearly all) policy may have been warranted in the early days of mass donation. It is definitely inimical, however, to the maintenance, over a period of years, of a high volume of procurement. Failure scrupulously to observe the Red Cross regulations for rejection of donors is the cause of most syncope. The most widespread neglect is failure to exclude the donor with a history of repeated syncope or syncope of neurotic background. There are, unfortunately, inadequate regulations against attempted bleeding from obese or small-veined individuals.

The figures given below are mean for the 23 cities under study (3). Number of physicians engaged per city, 4.6; number of mobile units per city, 1.9; mobile and center units per city, 3.6. Of 7 cities with 3 mobile units only 1 has an outstanding record; of 9 cities with 2 mobile units, 2 make an excellent showing; 3 of the 7 cities with 1 mobile unit each are high producers. This figure is approximately 10 times the standard deviation and therefore is statistically significant. Although mobile units are generally considered highly effective, their superiority is not borne out by this study. Emphasis should continue to be placed upon the center units.

The number of hours of bleeding per week for a center unit was 33.2; the number of hours per week for a mobile unit (travel excluded) 28.5. The number of nurses per city was 30.0; the bleedings per nurse per week 105.9. Total hours of bleeding per center per week (all units) was 109.8; total bleedings per hour 27.8, and ratio of bleedings per hour to total hours 4.2. The average number of hours per week per nurse was 31.0; the mean rating (mean of bleeding per nurse per total hours and average bleeding per hour per nurse) 2.1. Overtime hours per week for center units (hours after 5 p. m.) was 11.6 or a mean daily closing time of 6:54 p. m.

Factors in ranking of cities.—The rank of cities is determined by the mean of the number of bleedings per nurse per week, and the mean rating. (The latter is derived from bleedings per nurse per total hour and average number of bleedings per nurse-hour.) The weekly production per nurse is thus balanced with the production per hour figure, so that gross performance and efficiency are equally weighted in the final ranking. The difference in over-all performance is illustrated by the peak of 156 bleedings per nurse per week (Cincinnati) and the low of 78.1 per week (Buffalo). Similarly, the spread in mean rating is from 2.9 to 1.4. It is evident that this difference in performance is of more than academic interest. The cities are ranked as follows in order of performance: 1. Cincinnati. 2. St. Louis. 3. Detroit. 4. Pittsburgh. 5. Hartford. 6. Rochester. 7. Chicago. 8. Cleveland. 9. Kansas City. 10. New York. 11. Washington. 12. Columbus. 13. Brooklyn. 14. Milwaukee. 15. Minneapolis.

16. Boston. 17. Philadelphia. 18. Harrisburg. 19. Schenectady. 20. Atlanta. 21. Baltimore. 22. Indianapolis. 23. Buffalo.

In tables 2, 3 and 4, three groups of 3 cities each are listed with performance data. The 3 cities with the highest yield per nurse per week (table 2), Cincinnati, St. Louis, and Detroit, also have 2 of the 3 highest mean rating scores. The best over-all production figures are achieved with average number of working hours, an average amount of overtime, and a low total of mobile teams (2 per city). These cities have 1, 2 and 3 mobile units respectively, and totals of 3, 3 and 5 bleeding units with 4, 4 and 6 doctors. The total number of bleeding teams in operation in these cities is low (3.7 per city).

TABLE 2.—*The leading centers*

City	Ranking number	Number bleedings per nurse-week	Ratio bleedings per hour to total hours	Mean rating	Total hours bleeding per week	Average hours per nurse per week	Hours per week, center unit	Overtime (hours)
Cincinnati.....	1	156	0.24	2.9	102.0	35.0	36.0	27.0
St. Louis.....	2	150	.30	2.9	100.5	33.1	40.5	7.0
Detroit.....	3	135	.24	2.7	144.0	28.8	27.0	12.0
Averages.....		147	.26	2.8	112.7	32.3	31.1	15.3
Deviation from mean.....		+41.1	0	+ .7	+2.7	+1.3	-2.1	+3.7

The 3 leading centers with highest weekly procurement per nurse, also have the 2 highest mean ratings (mean of bleedings per nurse per total hours and average number of bleedings per nurse-hour). This excellent record is achieved with average number of working hours and average overtime.

The second group of cities (table 3), Hartford, Brooklyn, and Minneapolis, are listed as the most efficient producers. This is evident from the ratio of bleedings per hour to total hours. The mean rating is also high in this group, which is headed by Hartford. The hours of bleeding and hours of overtime are much less than average (minus 37.4 and minus 8.3 deviations respectively), a fact which accounts in part for the high rates of bleeding per hour in relation to total hours. Good management, and saturation of donors during bleeding hours make possible these unusual figures. These cities all have relatively small centers, with one mobile and 2 center units (bleeding teams), or vice versa, 3, 3 and 2 total units, and 3, 5 and 3 doctors, respectively.

TABLE 3.—*Most efficient centers*

City	Ranking number	Number bleedings per nurse-week	Ratio bleedings per hour to total hours	Mean rating	Total hours bleeding per week	Average hours per nurse per week	Hours per week, center unit	Overtime (hours)
Hartford.....	6	104.0	0.52	2.8	72.0	23.4	36.0	0
Brooklyn.....	13	93.5	.50	2.2	77.0	25.6	26.5	10.0
Minneapolis.....	15	94.0	.45	2.0	63.0	31.3	36.0	0
Averages.....		97.1	.48	2.3	70.7	26.7	32.8	3.3
Deviation from mean.....		-8.3	+ .26	+ .2	-37.4	-4.3	- .4	-8.3

These centers have the highest hourly rates of procurement in relation to total hours of bleeding, making them the most efficient producers. Hours of bleeding and overtime for this group are less than the mean. These are small centers, with 1 mobile and 2 center units, or vice versa.

It is seen that a relatively small number of total units per city promotes saturation of donors. It must not be assumed that saturation produces a "speed-up" in bleeding. The highest average bleeding rate per nurse per hour attained in this series is only 4.6. It would be possible to improve this rate if donors were transported on stretcher or table to a recovery bed, thus freeing the bleeding table at the end of each bleeding. A similar effect could be secured by providing 5 or 6 (instead of 3) bleeding tables for each nurse.

It should be noted that the weekly production of these efficient centers could actually be increased by extending bleeding hours to more average figures.

The last 3 cities listed (table 4) are the least efficient producers (Baltimore, Indianapolis, and Buffalo). These cities are lowest in all production factors. They are characterized by relatively long hours and high overtime (plus 18.5 and plus 10.7 deviations, respectively). This "stretch-out" contributes to the low bleeding rate per hour, but the low total bleeding per nurse per week is not influenced by these factors. The centers in question have a relatively large number of nurses in relationship to output. Their records could be improved statistically by reducing staffs and shortening hours. Procurement increase, however, cannot be anticipated here without an improvement in one or more apparently faulty elements in the intangible appeal. The cities of this group operate 2, 2 and 3 mobile units, 4 and 5 total units, with 4, 4 and 5 physicians respectively.

TABLE 4.—*Least effective centers*

City	Ranking number	Number bleedings per nurse—week	Ratio bleedings per hour to total hours	Mean rating	Total hours bleeding per week	Average hours per nurse per week	Hours per week center unit	Overtime (hours)
Baltimore.....	21	82.5	0.10	1.6	132.0	32.7	36.0	27.0
Indianapolis.....	22	76.9	.14	1.6	117.0	29.2	36.0	20.0
Buffalo.....	23	78.1	.14	1.4	131.0	32.2	44.0	20.0
Averages.....		82.7	.12	1.5	126.6	31.3	38.7	22.3
Deviation from mean.....		-23.2	-.14	-.6	+18.5	+3	+5.5	+10.7

These are lowest in all important production factors, excelling only in number of hours of bleeding and in overtime.

Influence of overtime on procurement.—Three cities with the highest number of hours devoted to bleeding after 5 p. m. were studied to determine the influence of night bleeding upon procurement. These cities, Boston, Cincinnati, and Baltimore, average plus 15.4 deviation from the mean in overtime. (The hours of bleeding for mobile units are not considered in these overtime estimates. The mean last appointment hours of mobile units is 6:17 p. m. Two cities report their latest appointment hours as late as 7:30 p. m.) The 3 cities with the highest overtime in center units comprise an excellent, a fair, and a

poor producer. Their mean bleeding per nurse has plus 6.9 deviation from the mean, their mean rating minus 0.1, and the mean ranking of the cities is 13.7 on the 1 to 23 scale.

Obviously, excessive night bleeding does not promote high total yield or efficiency in procurement. The mean ranking of the 5 cities with no bleeding in center units after 5 p. m. is 12.0. This should not be taken to indicate that overtime bleeding is undesirable. The output of the 5 cities without overtime could actually be improved by judicious use of early evening time (Hartford, Chicago, Minneapolis, Atlanta, and Harrisburg). It is clear, however, that the reliance placed by some centers upon late closing (9 p. m.) must be seriously questioned. Two hours should provide sufficient time to bleed donors who cannot report before 5 p. m.

It should be emphasized that mass bleeding is a highly intensive and fatiguing duty. Long hours and night bleeding accentuate fatigue in nurses, with a tendency to an increase in unsuccessful bleedings and traumatized arms. Added fatigue is also present in the night-time donor, with increased liability to syncope. It is not a coincidence that the best procurement records have been established in cities with mean bleeding hours and mean amount of overtime.

CONCLUSIONS

1. Analysis of the returns of 23 Red Cross blood donor centers shows the ratio of mass blood procurement to population to be directly inverse (law of diminishing returns).
2. The best production records are associated with a mean number of total bleeding hours per week and low number of mobile units.
3. Variations within the limits exhibited are related to intangibles, of which adequate consideration of the donor as an individual is most important.

REFERENCES

1. POLES, F. C., and BOYCOTT, M.: Syncope in blood donors. *Lancet* 2: 531-535, November 7, 1942.
2. Editorial: Faints among donors. *Lancet* 2: 549, November 7, 1942.
3. Preliminary estimates of civilian population of metropolitan counties, March 1, 1943. Bureau of Census, Washington, D. C., August 24, 1943. (Corrected for war populations.)



SCIATIC NERVE STRETCHING TESTS

Sciatic nerve stretching tests include those maneuvers which stretch the sciatic nerve mechanically, thereby intensifying the pain and increasing the manifestations of root irritation.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

THE SAFE UNIVERSAL DONOR

EDWARD A. MULLEN
Captain (MC) U. S. N. R.

The treatment of surgical emergencies due to military operations occasionally necessitates the use of universal donors. Amphibious transports are subject to such emergencies and a study of the possibilities of the use of universal donors aboard was made with the following conclusions and results.

Preliminary to further study, consideration was given to the relative advantages of the blood bank as opposed to the use of universal donors. This study indicated the superiority of the latter method on this type of ship for the following reasons:

1. This type of ship has a complement of its own personnel on board who are available at all times and give a permanent supply of blood.
2. Lack of adequate space for the proper storage of blood.
3. Simplicity of procedure.

In making the study, donors were selected as follows:

1. Health records of all type "O" personnel were checked and those with a history of any venereal infection, malaria, allergy, or other diseases were excluded. After these were eliminated 200 were found qualified for further study.

2. Blood was drawn from all persons at 0900.

3. A standard Kahn test was performed on each serum.

4. Each person was retyped with the routine technic for blood typing.

5. Each donor's serum was tested for agglutinins "A" and "B" in a series of different titers.

Since reactions following the use of a universal donor have been reported in the literature, means to exclude these were considered necessary. The procedure employed determined the serum titers. The technic used was that outlined by Boerner.

The results obtained were as follows:

Serum dilution	"A" cell suspension	"B" cell suspension
1:4.....	1	9
1:8.....	7	17
1:16.....	18	44
1:32.....	55	114
1:64.....	54	39
1:128.....	33	19
1:256.....	14	1
1:512.....	4	1
1:1,024.....	2	1

The total number of blood serums examined was two hundred. No positive Kahn tests were elicited.

In the opinion of Wiener¹ any titer over a dilution of 1:32 for "A" cells and 1:64 for "B" cells is potentially dangerous. However, he believes that dilutions up to and including 1:128 might be used, providing the blood is injected very slowly.

APPLICATION

A report is made on the determination of titers of 200 type "O" selected personnel.

Twelve and one-half percent of errors in previous typings were found, confirming reports in the literature.

Of the remainder, 32 percent were safe for type "A" recipients and 65 percent for type "B". An additional 32 percent for type "A" and 22 percent for type "B" were available provided the blood was injected very slowly.

The balance over the above percentages was considered as potentially dangerous.

A large number of potentially dangerous "O" donors was found.

No positive Kahn serum reactions were found in the selected group. Health records and identification tags were corrected and a note of the titer dilution was made in the health records.

NOTE.—Since the above article was submitted for publication, advantage was taken in the combat zone of the use of the universal donor for 12 cases. No reactions were experienced and beneficial results were observed in each instance.

¹ WIENER, A. S.: Personal communication.



SYMPTOMS OF EFFORT SYNDROME

While the symptoms are variable, they consist chiefly of rapid heart action, breathlessness, dizziness, fatigue, and pain in the region of the left breast. The physical signs are fairly characteristic, and the most constant are these:

(1) The general expression usually denotes fatigue, the facial expression being tired and expressionless. In some cases the general demeanor suggests apprehension. (2) The cardiovascular system is normal, by both clinical and laboratory standards, except that tachycardia of effort is excessive. At rest the pulse rate is usually increased when the patient is examined by the doctor, but it is apt to be normal when recorded by the nurse or during sleep. (3) The hands are bluish, cold, moist, and usually tremulous. (4) Sweat often pours from the axillae during the examination. (5) Frequent sighing is common.—GORDON, K.: Effort syndrome. *Canad. M. A. J.* 50: 362-363, April 1944.

AIRSICKNESS

RUSSELL G. WITWER

Lieutenant Commander (MC) U. S. N. R.

In order to evaluate the subjective responses of pilots to airsickness a questionnaire was given each airsick trainee at this station, inviting his personal expressions and comments on the subject.

The probationer pilot undergoing instruction in Naval aviation is subjected to a rigid training routine. He is rapidly taken through simple maneuvers and difficult stunting, both with an instructor and alone. In addition to this he attends classes and also undergoes a strenuous course of physical training. Due to wartime conditions his training, while thorough, must be completed in the shortest possible time. This explains the relative frequency of airsickness in men who have had previous training in flying. Many of them had a great deal of time in the air as civilian pilots, but few experienced the rigid training, long flying hours, and perfection required at this activity.

The following causes were tabulated from a survey of the first thousand cases:

<i>Stated cause:</i>	<i>Number of cases</i>
No stunt interval (continuous stunting without rest)---	114
Fumes (gas fumes during inverted spins, etc.)-----	108
Improper food-----	107
Lack of previous training in stunts-----	87
Fear or nervousness-----	83
Insufficient rest-----	79
Not mentally occupied-----	74
Interruptions in training-----	44
Eyes fixed inside cockpit-----	40
Too many liquids (during hot weather)-----	38
Flying with an instructor-----	37
Poor physical condition-----	36
Warm weather-----	30
Uncomfortable clothing-----	19
Alcoholic excess-----	18
Rough weather-----	18
Loose safety belt-----	15
Eyes not fixed on distant object-----	15
Excessive smoking-----	11
Position in plane-----	8
Position of seat (too high or too low)-----	5
Association (watching someone else be airsick)-----	4
Sandbagging-----	3
Salt tablets-----	2
Hurried meals-----	2
Vomitous fumes-----	1
Poor instruction-----	1
Any autogyration-----	1
	<hr/> 1,000

Of these 1,000 patients, 402 gave a history of having been airsick before arriving at this base. The term airsickness as used in this report

is to be interpreted in its broadest sense. The trainees were told to consider any degree from a simple sense of nausea to actual vomiting and incapacity.

It has been the contention of the instructors that a great proportion of all cases of airsickness are due to fear or nervousness, their figures ranging from 70 to 98 percent. The factors as given by the trainees themselves having as their basic causes fear or nervousness include:

No stunt interval.....	114
Fumes.....	108
Lack of previous training in stunts.....	87
Fear or nervousness.....	83
Not mentally occupied.....	74
Interruptions in training.....	44
Eyes fixed inside cockpit.....	40
Flying with instructor.....	37
Loose safety belt.....	15
Eyes not fixed on distant object.....	15
Association.....	4
Sandbagging.....	3
Poor instruction.....	1
	<hr/>
	62.5%

The following factors might also be caused by fear or nervousness:

Insufficient rest.....	79
Poor physical condition.....	36
Uncomfortable clothing.....	19
Rough weather.....	18
Position in plane.....	8
Position of seat.....	5
Vomitous fumes.....	1
	<hr/>
	16.6%
	<hr/>
	62.5%
	<hr/>
	79.1%

Thus the trainee agrees that approximately 75 to 80 percent of his trouble is due to these basic factors. The remaining 20 percent may be classified under faulty eating or drinking habits, warm weather, excessive smoking, and alcoholic excess.

The 107 men who claimed that improper food caused their sickness were asked to elaborate. Sixty-one of them blamed the type of food, gas-forming foods (beans, onions, fried foods, etc.) as being the chief offenders. Sixteen stated that irregular eating habits were the cause. The remaining 30 felt that quantity, either too little or too much food, was the causative factor.

A definite increase in airsickness was noted during the hot summer months. Undoubtedly the flier is more uncomfortable at this time, and his discomfort probably has a tendency to increase his nervousness. For the same reason he consumes larger and perhaps excessive quantities of water.

Much has been gained from the suggestions of the trainees in the way of treatment. It is felt that the incidence of airsickness at this station has been greatly reduced by the following precautions.

Instructors were asked to:

1. Give a period of relaxation between stunts. This could be achieved by allowing the pilots to circle the field for a few minutes, or taking over the controls themselves, at the same time distracting them with informal conversation.
2. Give a review of the maneuvers to be undertaken in the course.
3. Try to establish a feeling of utmost confidence between themselves and the trainee. It is felt that the old method of "wringing out" the airsick pilot and repeating the procedure until he overcomes his feeling is definitely passé.
4. Allow the probationer pilot time to orient himself and become accustomed to the stunt before starting a new one.

Pilots were urged to:

1. Eat regularly, frequently, and in moderation.
2. Maintain good physical condition. Many patients were completely "cured" after a few days' rest.
3. Be mentally occupied. Sandbaggers and passengers should try to follow through all stunts, and not allow their minds or eyes to rest too long on the instrument panel.
4. Exercise moderation in smoking and drinking.

Prophylactic medication was instituted. Seventy percent of the airsick pilots obtained some relief from placebo medication with bicarbonate of soda or powdered sugar. After one week of this treatment they were told that the capsules contained nothing of medicinal value and the relief persisted. Sedation in the form of $\frac{1}{4}$ grain of phenobarbital was given in a few selected cases. Instructions were to take one tablet one-half hour before the stunt hop. The value of this medication was doubtful.

Last, but most important, the flight surgeon explained how and why nervousness or fear can cause this condition. He reassured the trainee and showed him that there were only a few men who were unable to treat and cure themselves of airsickness. This was supplemented by a talk with the instructor, giving him a few hints on how to aid trainee pilots under his care.

ULTRAVIOLET IRRADIATION RELATIVE TO ANOXIA AND BEND SUSCEPTIBILITY

PRELIMINARY INVESTIGATION

WILLIAM M. DAVIDSON

Lieutenant Commander (MC) U. S. N. R.

The history of blood irradiation dates back to 1925. It has been used in pathologic conditions with good results, especially in pneumonias and septicemias. Individuals having marked cyanosis due to pneumonic consolidation when given this treatment showed prompt relief with dramatic drops in temperature, pulse and respiration. The same effects have been noted in the treatment of severe asthmatics.

The literature shows an increase of oxygen saturation of the blood within 3 to 5 minutes following irradiation. The increase of oxygen saturation in the blood as shown by blood chemical determination apparently goes on for approximately 30 days. The effect of this treatment on tissue and cell metabolism especially with relation to usage of oxygen is not clear. There does seem to be an increase in general resistance following this therapy with an obvious relief from fatigue.

Considerable literature has accumulated on this subject since 1934 under the title of the Knott technic of hemo-irradiation. Its use in raising the ceiling of aviators by increasing the individual's ability to pick up and utilize oxygen more readily under decreased partial pressure of oxygen suggested itself for experimental trial. It appeared to be a problem which could be ascertained with runs in the low-pressure chamber. Moreover it was felt that a study of bend susceptible individuals before and after irradiation could be undertaken.

Procedure.—Individuals were given low-pressure chamber runs testing both their anoxic and bend response. The anoxia was measured first by a photoelectric cell oximeter which registered oxygen saturation in terms of milliamperes. The bends were graded types 1, 2 and 3, depending on the severity of symptoms. Low-pressure chamber runs were made before and after irradiation so that each subject acted as his own control. Individuals ranging from 18 to 38 years of age were used in the tests. Anoxia runs consisted in going to 18,000 feet for varying lengths of time without oxygen, taking readings every minute and checking the time blood oxygen saturation returned to normal upon the use of oxygen. Bend susceptibility was checked by a

1-hour run, 50 minutes at 38,000 feet and 10 minutes at 42,000 feet, unless the subjects had to come down because of incapacitating bends before the 1-hour interval.

Blood irradiation.—Hemo-irradiation therapy¹ consists in exposing a part of the patient's blood to ultraviolet rays. A predetermined amount of the patient's blood is withdrawn from a vein and citrated. The blood is then strained into a transfusion graduate and returned to the same vein through an air-tight conduit. A specially designed irradiation chamber with a quartz window is connected into the conduit. The chamber is about 2 inches in diameter and approximately 1 inch thick; it has an inlet and an outlet and connecting the two is a labyrinthine passage formed by baffle plates which are ground to fit flush against the quartz window. The blood must flow around instead of across them. As the blood passes through the channels of this chamber it is exposed to ultraviolet rays generated by a water-cooled mercury vapor quartz burner. The distance from the source of the ultraviolet rays to the blood is approximately 3 cm. The period of time exposure for each cubic centimeter of blood irradiated was 10 seconds. The total amount of blood irradiated was 1½ cc. per pound of body weight. The procedure is as easily carried out as is the administration of any venous solution.

Findings.—Nine runs were made on 6 individuals as to their anoxic response. On 7 (77 percent) of the runs, improvement was noted. No decrease from the normal was observed. Twenty-eight runs were made on individuals with relation to their known susceptibility to the bends. On 24 runs (85 percent) marked improvement was noted. There was definitely decreased susceptibility in the remainder. The effect seems to last about 3 weeks.

¹ HANCOCK, V. K.: Treatment of blood stream infections with hemo-irradiations. *Am. J. Surg.* 58: 336-344, December 1942.



SULFAMERAZINE

Sulfamerazine is the monomethyl derivative of sulfapyrimidine, or in other words, methyl diazine. It is the close relative of the dimethyl compound, developed originally in England. Experimental and clinical evidence indicates that it is effective in the treatment of pneumococcal, meningococcal, hemolytic streptococcal and gonococcal infections. It is more rapidly and more completely absorbed from the gastrointestinal tract than sulfadiazine or sulfathiazole, and is excreted much more slowly. This permits the swifter attainment of a high therapeutic blood level, and insures its maintenance over a longer period of time. This results in more economical treatment.—HOLLAND, M. O.: New developments in pharmaceutical practice. *Am. J. Pharm.* 116: 102-109, March 1944.

EXPERIMENT IN PSYCHOTHERAPY DURING SELECTION EXAMINING

JAMES H. CLOSSON
Commander (MC) U. S. N. R.
and
HAROLD M. HILDRETH
Lieutenant H-V(8) U. S. N. R.

The chief purpose of the neuropsychiatric units operating in training stations and induction centers throughout the country is the elimination of the mentally and emotionally unfit. Each recruit must be examined and the following specific questions answered regarding him: 1. Can he adapt himself to the vigorous conditions of service life? 2. Can he make the adaptation quickly enough to be valuable? 3. Can he do it well enough to be an asset to his unit? These predictions must be made in a minimum of time, as the number of recruits is customarily large and the staff small.

The pressure of the situation has always seemed to preclude therapy. Prolonged experience in examining recruits at a Naval training station, however, made certain members of the neuropsychiatric staff feel that the selection examining situation not only required but was peculiarly favorable for psychotherapy, even though it must necessarily be of an extremely brief variety.

The need for therapy is most apparent in dealing with borderline cases. During a 3-minute interview the more obviously unfit individuals can be recognized, as well as many of those who are essentially unstable despite favorable appearances. There are a great many cases where the final adjustment of the man, and his ultimate usefulness, depend on his initial reaction to the service. If he becomes emotionally "jammed" during his introduction to the new situation the confining routine will promote his disorganization and he may very rapidly become a serious misfit. If, on the other hand, he gets off to a good start the intense life of the Navy will tend to strengthen him rapidly and establish a satisfactory pattern of behavior.

Assuring this initial adjustment is important both for the adolescents who have not yet stabilized, and also for older individuals of precarious stability—the persons who get along well if the environment is reasonably favorable. The experiences and reactions of the first few weeks go a long way toward determining whether the Naval environment will be "favorable." Such patients need psychologic

preparation to help them get a good start, and it is easier to accept them for duty if some prophylactic therapy can be given.

The selection examining situation is also extraordinarily favorable for psychotherapy. The psychologic experience of the recruit coming into the service, his new surroundings, new responsibilities, and need to "make good" in a new situation, all render him unusually receptive to a therapeutic approach. His customary defenses are down, he is more readily reached, and is more alert and attentive. He is being examined for fitness in a situation where thousands of other men have proved themselves. The recruit is facing the need for a more rapid adjustment to new surroundings, new routines, new people, new skills, than he has ever faced in his life. How well will his previous reaction patterns serve him? How much and in what ways will he have to change? He is not only ready for helpful suggestions, but is often eager for them.

PROCEDURE

On the basis of the obvious need for psychotherapy, and the unusual opportunity for it, we began thinking about ways of incorporating therapeutic measures into the screening examination. With the time restriction in mind it was clear that any procedure adopted would have to be brief and selective. After considerable thought and experimentation the following was decided upon:

1. *Each contact should have therapeutic emphasis.*—Planned or not, every interview does have an effect of some sort on the person who is being interviewed. Whether or not this effect is favorable depends on the manner in which the interview is conducted. Even in asking the bluntest personal questions the tone of voice can still carry reassurance, and even though no specific suggestions are given, a degree of self-confidence can be instilled in the man by the manner in which questions are asked. Psychiatric questioning can be done in such a way that it has a therapeutic effect.

2. *Questioning should be directed toward discovering the man's "weak spot."*—In every individual there is one behavior pattern which has been giving him trouble in the past and which represents the weakest point in his total adjustment. This particular reaction is the one most likely to cause crack-up or failure in the service. It is also the point at which therapy will be most effective. A therapeutic orientation on the part of the examiner tends to sharpen the search for this weakest point in a man's adjustment, because there is the intention of doing something about it once it is discovered. It provides, in addition to the general purpose of passing on the man's fitness, a further immediate reason for locating the weak spot. The therapeutic approach is also advantageous in another way. Observing the way a man reacts to therapeutic suggestion frequently tells a great

deal about him. The degree of resistance or acceptance he shows toward attempts at modifying his behavior helps in the diagnostic evaluation of his adaptability.

3. *Therapeutic suggestions should be direct.*—Questioning and therapy are best carried out in a direct, straightforward manner, with no time-wasting subtleties or indirections. Tactful prodding into awareness is a luxury of peacetime. A hard, solid piece of advice, given in a forthright manner, is more acceptable to the recruit. He knows that time is short. Even though it is concentrated therapy, he will have plenty of time to think it over, assimilate and use it.

4. *Each man should be given at least one direct therapeutic suggestion.*—There is always time for one. It may be a remark preparing him for anticipated difficulties, as in the case of recruit B. It may be a statement or even a question suggesting to the recruit a method of meeting situations which he has never tried.

The following case reports illustrate the suggestions that can be given quickly.

CASE REPORTS

Recruit A was a farm lad who had just reached the age of 19 and was away from home for the first time. He was overwhelmed by the distance he had traveled, the "newness" of everything and the contact with so many personalities. He was on the borderline of tears. To help this recruit through the transition facing him he was told that there was a first time for everyone to be homesick, that thousands of men were homesick the first few days and he need not feel ashamed of it, that he would be over the worst of it in a short time.

Recruit B had enlisted at the age of 17. He was well-built, alert, eager and also very young and inexperienced. This subject had been unusually sheltered and when asked if he had a steady girl became red and stammered that he had never even had a "date." His parents were "pretty strict about things like that." It was clear this recruit needed an orientation which would help him adjust to the "kidding" he was bound to receive. He was told that others would probably "kid" him about his innocence but would mean no harm by it. This boy was warned he would hear talk about sexual matters he had not heard before, but that was because most of the men would be older and their ideas and interests different. He would not need to do all the things they did, but should try to understand them rather than be shocked. It was his opportunity to learn more about what people were like.

Recruit C showed a reluctance to answer questions about his family, but on being pressed acknowledged that his parents were divorced. In the resulting emotional disturbance he found himself conflicted and full of distrust toward others. This recruit had the background for developing into an extremely suspicious and seclusive individual. He was told: "Sometimes you wonder if you can ever trust anyone again, is that right? Well, just remember that others aren't your parents. Don't hate them for something your parents did; take them as you find them. Your job is to build your own life, and you have an opportunity now to develop your own personality. The other men won't know or care about your family; they will be interested in you. It is a new situation, make the most of it."

Recruit D joined the Navy to see the world, but more particularly to learn a trade. He was deeply in earnest about furthering his education, since he had completed only the seventh grade. He faced a severe disappointment in the Navy, as his general intelligence appeared to be below average and there was little probability that he would be admitted to a service school. This recruit was told that only a limited number could be taken in the schools and therefore he should not be disappointed if he was sent to sea first. The Navy would then put him where he was needed most. After the war there would be more educational opportunities and in the meantime he could learn a great deal by keeping his eyes and ears open and could develop the habit of doing well every job given him.

Recruit E was arrogant, demanding, self-centered and his attitude that he was better than anyone else foreshadowed a difficult adjustment. It was pointed out to him that he was coming into an organization of two million men where a man had to "deliver the goods." He was told directly that his manner was going to make it difficult for him because everyone was on an equal basis and nobody liked a man who appeared conceited. Of course what he did was entirely up to him, but it was suggested that he might try out in the Navy a new manner of dealing with people, and send some of his civilian attitudes and notions back home along with his civilian clothes. This man was unresponsive at the time but a few weeks later dropped in to see us. His manner was still "cocky," but less antagonistic. "I'm all Navy now, Doc."

Recruit F, 18 years of age, was bashful, timid and insecure. He admitted feelings of inferiority and said he was quite concerned about "what other men will think of me." He was told that everyone around him would be starting on the same plane, that very few had any service experience, and that everything would be as new to his shipmates as to him. Some of them would try to bluff it through but it was better to admit ignorance and get a good foundation than to pretend to know all about it and never really learn anything.

Recruit G was a single, 29-year-old truck driver, likeable but inclined to "buck" everything. He made a point of telling how he had always been ready with his fists, and on more than one occasion had argued himself out of a job. It was easy to picture him at mast. He was reminded that many of the men in his unit would be younger than he, some of them just "kids" and it was the job of men like him to steady them, show them how to take orders like a man, teach them to pull together and help weld them into a team.

EXPERIMENTAL CHECK

After putting this therapeutic method into practice we wondered whether it was having any effect whatsoever. Was one suggestion per man making any observable difference in the adjustment of recruits? Against the background of peacetime therapeutic experience such a technic would seem without value except possibly in a few exceptional cases. On the other hand it began to appear that some of the recruits remembered with considerable vividness the suggestions made to them in the screening interview. It was decided to make an experimental check on the effectiveness of this method of "streamline" therapy.

Each day's incoming recruits were divided into two groups: An experimental group which received psychotherapy, and a control group which did not. The division was made by putting the first 10 men off the line into one group, the next 10 into the other.

Four weeks after examination all men who had been sent directly to recruit training were given a rating by their company commanders on their adjustment to Navy life. Each commander was asked to rate his men as Satisfactory, Unusually Good, or Unusually Poor.

It was found that the company commanders varied considerably in the number of men they put into each category, some of them rating a large percent as Unusually Good and some putting a small number in this category. This tendency had been foreseen however and was taken care of in advance by the method of selecting the two groups. Half the men assigned to each company were in the experimental group and the other half in the control group, so any individual tendency in rating shown by a particular company commander operated equally on the two groups.

This experimental check was started with a sample group of 200 men. When the results turned out to be unexpectedly favorable an additional 400 and then a final confirming group of 400 more were studied.

RESULTS

A tabulation of ratings for the entire 1,000 cases showed the following results:

	<i>Experimental group</i>	<i>Control group</i>
Unusually Good.....	202	160
Satisfactory	256	279
Unusually Poor.....	42	61

To test the significance of these findings and to see whether they represented more than chance fluctuation, the chi-square test of statistical significance was applied. The value of this statistic proved to be 9.37. Interpreted in terms of probability this means that there is less than 1 chance in 1,000 that such a distribution could be obtained by chance. There is, therefore, a real and reliable difference between the 2 groups.

Psychotherapy, administered in small amounts during screening, does make a discernible impression on the general adjustment of the group.

EXPERIENCES IN THE USE OF THE KENT BATTERY

JOHN A. WHEELER, JR.

Lieutenant, junior grade D-V(S) U. S. N. R.

STANLEY B. WILLIAMS

Lieutenant, junior grade H-V(S) U. S. N. R.

WILLIAM A. DRUMMOND, JR.

Pharmacist's Mate, third class U. S. N. R.

and

JOHN D. HARRIS

Specialist X, second class U. S. N. R.

The following statistical data represent our experience in the use of the Kent Battery for measuring mental ability. The form of the battery employed has been described by Hunt and his coworkers.¹ It consists of: Easy Directions (ED); Arithmetical Reasoning (AR); Oral Emergency Test (EGY), and Verbal Opposites (OPP). Subtests ED and AR are written; EGY and OPP are oral. Each subtest has a standardized mental age equivalent and the median of the four is taken as the mental age score for the entire battery (MMA). The mental age can be determined for the written tests (ED + AR) and for the oral tests (EGY + OPP) separately.

The subjects used for the following computations consist of 673 cases from the files of the psychology department at the U. S. Naval Training Station at Sampson, N. Y. The group as a whole is selective, consisting of recruits suspected of mental deficiency and therefore it is not representative of the total recruit population. No illiterates are included. The median mental ages (MMA scores) of this group range from 8 to 14 years with a mean of 10.97 years, a median of 10.94, a quartile deviation of 0.68, and a standard deviation of 2.01. The distribution of these scores is approximately normal, being neither significantly skewed nor leptokurtic by statistical test. The Pearson correlation coefficients with their standard errors appear in table 1; those involving subtests versus composites are left uncorrected because of the frequent use of combinations of subtests as independent batteries.

¹ HUNT, W. A.; WITTON, C. L.; HARRIS, H. I.; SOLOMON, P.; and JACKSON, M. M.: Psychometric procedures in detection of neuropsychiatrically unfit. U. S. Nav. M. Bull. 41: 471-480, March 1943.

TABLE 1.—*Pearson correlation coefficients*

Test	AR	EGY	OPP	EGY+OPP	MMA
ED	0.38±0.03	0.39±0.03	0.27±0.03		
AR		.17±.03	.26±.03		0.68±0.02
EGY			.54±.02		.72±.01
ED+AR				0.53±0.03	.81±.01
EGY+OPP					.83±.01

Correlation between Kent and other measures.—Although our available sample is at present too limited in range to permit adequate correlational study of the Kent Battery and the Wechsler-Bellevue scale, preliminary coefficients from a small sample of borderline cases approximate 0.25. Positive correlations of a similar order have been obtained between the Kent and the new General Classification test. For example, the Pearson correlation between the Kent MMA and the GCT is 0.19, S. E. 0.08, for GCT scores below 30; but the correlation between EGY alone and the new GCT (scores below 30) is approximately zero. These meager relationships only serve to emphasize the need for administering individual tests of intelligence to recruits of low mental ability.

TABLE 2.—*Individual adjustment questionnaire*

Question	r bis	P. E.
1. Does he learn easily?	0.09	0.04
2. Is he awkward in drill?	-.01	.02
3. Would you select for service under you aboard ship?	.05	.05

Bi-serial correlation coefficients were computed between the Kent median mental age and the answers (yes or no) given by recruit training company commanders to each of three questions pertinent to the mental ability of the recruits. These questions are part of an individual adjustment questionnaire routinely obtained from company commanders on questionable recruits. The coefficients with their probable errors, are presented in table 2.



KNEE-ROCKING TEST

The patient is placed in the supine position. One hip and knee are so flexed as to place the external malleolus on the patella of the opposite extremity. This can be done in the normal individual easily and without discomfort. If the case is one of arthritis of the hip joint or other hip joint disease, pain is promptly elicited upon depressing or rocking the knee.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

THE CHANGING PICTURE OF POSTPNEUMONIC EMPYEMA THORACIS

COMPLICATING SULFONAMIDE-TREATED PNEUMONIA

CLIFFORD D. BENSON

Commander (MC) U. S. N. R.

and

CHARLES W. McLAUGHLIN, JR.

Lieutenant Commander (MC) U. S. N. R.

Before the introduction of sulfonamide therapy the diagnosis and management of postpneumonic empyema thoracis was well understood. Since 1938 chemotherapy has been generally used in the treatment of pneumonia with the result that the incidence of this disease has decreased from 5 percent to 2 percent, and its clinical course has been greatly altered.

During the past year at this hospital 31 patients with empyema thoracis have been treated by surgical drainage. This represents an incidence of approximately 2 percent of the patients admitted with a diagnosis of pneumonia; a figure in keeping with the findings of other observers during the past 4 years.

In the present-day management of pneumonia, typing of the offending organism is a procedure of minor importance. Serum therapy, which required immediate typing, is rarely used today. Typing is either omitted entirely or done at a later date when the sulfonamide medication given has affected the accuracy of the laboratory procedure. The bacteriologic study of the purulent fluids obtained in our patients yielded very different findings from those seen in presulfonamide days. In a previous study of 144 infants and children (1) the majority of whom were treated before sulfonamide therapy, the bacteriologic findings were: Pneumococci 74.2 percent; streptococci 10.7 percent; no growth 8 percent; influenza 0.9 percent. In contrast the pleural fluids in the 31 patients in the present series showed on repeated cultures: Pneumococci 36.6 percent; streptococci 26.8 percent, and no growth 36.6 percent.

CHARACTERISTICS OF THE PLEURAL EFFUSION

The majority of our patients gave histories of an ambulatory infection, a "cold," with some fever of two to three weeks' duration to which they paid little attention. The onset of the pneumonia was

characterized by high fever and three to four days later the development of a pleural effusion.

The pneumonia was usually of the patchy or diffuse bronchopneumonic type similar to that seen in World War I. It was distinctly not a virus pneumonia, which in our experience has been free from complicating empyema. The pleural effusion persisted during the acute phase of the pneumonic process and had a tendency to persist or recur in a short period after the patient became afebrile. The usual clinical picture of the pneumonia resolving by crisis or lysis, followed shortly by a temperature rise, and the early finding of a purulent effusion, was striking by its rarity. In a limited group of patients who developed a localized effusion the preceding pneumonic process was lobar in type.

The fluid noted in many of our patients was reddish brown and the supernatant fluid contained a minimum of cellular elements and fibrin. Pus cells and fibrin were present, however, in the dependent portion of the pleural cavity. Even though the fluid was sterile on culture, due partially to sulfonamide therapy, it often persisted for weeks before becoming purulent. Burford and Blades (2) made this observation in their series reported in 1942.

The fundamental principles emphasized by Graham and Berck (3) in the treatment of acute empyema are still of paramount importance. However as a result of our recent experience we feel that the following factors must be considered in determining the opportune time for surgical drainage in empyema complicating pneumonia treated by sulfonamide therapy.

The vast majority of these patients are not toxic or septic as the bacteriemia has been previously controlled by sulfonamide therapy. The pleural effusion in many of the patients is rendered sterile by the same agent. Sulfonamide therapy thus makes its real contribution in the treatment of the active pneumonic process and should be discontinued when this phase has been brought under control. In this series no benefit was observed from a continuation of sulfonamide therapy; further, its continued use when a pleural effusion was present served only to give a false sense of security and masked the presence of a developing empyema.

The presence of thick pus characteristic of a pneumococcus empyema was demonstrated on aspiration in only 33 percent of this series. In the remaining patients the fluid presented a reddish-brown mucoid appearance and contained a relatively moderate number of pus and red cells. This may have resulted in part from the prolonged use of sulfonamide therapy, but more likely was due to the fact that the effusion had been present for some time.

In the presulfonamide period when the specific gravity of the purulent pleural fluid was approximately 1.020, closed drainage was con-

sidered, and when the specific gravity measured 1.034 to 1.040, open drainage was practiced. In this series the fluid never measured over 1.030. The settling of solid elements in these pleural effusions over a 24-hour period was rarely over 30 percent, while in presulfonamide days approximately 60 percent was considered essential before resorting to open drainage. Empyemas with these low specific gravities, massive effusions, and limited solid elements required repeated and regular aspirations to reduce the size of the empyema cavity before instituting surgical drainage.

It has been demonstrated that mediastinal and diaphragmatic fixation occurs early in the course of empyema under sulfonamide therapy; this can be accurately determined by fluoroscopic and roentgenologic examination. Such fixation may occur as early as 18 to 21 days from the onset of the effusion and is a reliable guide for the institution of surgical drainage. Berman's (4) emphasis of this point is important because these patients can be operated upon earlier than formerly and their recovery greatly hastened.

Anteroposterior and lateral roentgenographs are essential in every instance. Multiple aspirations to obtain the lowest point for safe dependent rib resection is a basic procedure (5). In certain instances the injection of a small amount of air and lipiodol into the pleural cavity will assist in determining the most dependent point for surgical drainage. When a huge empyema cavity with almost complete collapse of the lung is present, and the diaphragm is fixed, a subperiosteal resection of about 2½ inches of the ninth rib in the posterior axillary line gives satisfactory dependent drainage. In the localized or loculated cavities the rib chosen for resection must supply dependent drainage to the collection and this can only be obtained by accurate localization on the roentgenographs and by careful aspiration.

In this series 22 patients had huge cavities; in 9 the pleural abscess was localized. In 13 of the 22 patients with huge cavities rib resection with a closed Pezzar catheter No. 34 was carried out as an initial procedure, with subsequent replacement of the catheter by a large open tube in 7 to 10 days. Open drainage in all patients was maintained by rubber tubes ½ inch in diameter. Six of the patients had open bronchopleural fistulas at the time of surgical drainage; these have all healed.

POSTOPERATIVE TREATMENT

Multiple transfusions were given during the postoperative period to combat serum protein deficiencies and as a supportive measure. A high-caloric diet rich in protein was supplied, and a constant increase in weight was observed in most patients. Patients were allowed out of bed as early as possible, usually 2 or 3 days following surgical drainage.

In reviewing these cases it was apparent that the size of the empyema cavity was no criterion as to the rapidity of lung reexpansion.

The delay in instituting adequate surgical drainage due to the atypical course of postpneumonic empyema following sulfonamide therapy resulted in a thick pleura, especially parietal, and a fixed mediastinum and diaphragm. These factors have contributed to a prolonged healing time.

Drainage tubes were never removed until the empyema cavity was obliterated as demonstrated by cavity measurement and roentgenographic examination after lipiodol injection.

RESULTS

In the accompanying table are tabulated the 31 cases here reported. The patients have been classified into 3 groups on the basis of the size of the empyema cavity encountered at operation.

TABLE 1.—*Results in 31 cases of empyema thoracis*

Number of patients	Days of illness to surgical drainage	Days of drainage to complete healing	Broncho-pleural fistula	Mortality
Group I, 300-400 cc. cavity	8	56	78	0
Group II, 400-2,000 cc. cavity	14	41	67	0
Group III, 2,000 cc. and above	9	33	*102	1
Total	31	av. 42	av. 78	6
				3.2%

*One patient still under treatment. Average dosage sulfonamide per patient in series 73 grams.

It is noted that an average of 42 days elapsed from the onset of the pneumonia to the institution of surgical drainage of the complicating empyema. This fact emphasizes the atypical course of this disease when one of the sulfonamide compounds has been used in the treatment of the preceding pneumonia and during the period of the developing pleural effusion. This has resulted in a delayed diagnosis and surgical drainage of the empyema.

The 22 patients of this series comprising Group I and II have been restored to a duty status. The 9 patients in Group III had complicated empyemas, 6 having bronchial fistulas in association with complete or almost complete collapse of the lung at the time of operation. In 7 of these 9 patients the condition has entirely healed and the patients have returned to a duty status. The healing time averaged 102 days. The remaining 1 patient is still under treatment and has a residual empyema cavity of 450 cc.

The patient having the 450-cc. residual cavity had a complete collapse of the lung onto the hilum when admitted to the hospital. Fluoroscopic examination after removal of the pleural fluid revealed fixa-

tion of the lung and emphasized the urgent need for early and repeated aspiration to promote lung expansion and to prevent the development of a total empyema. The 1 remaining patient is showing a very slow progressive decrease in the size of his empyema cavity.

One death occurred in this series of 31 patients, a mortality of 3.3 percent. This patient despite adequate surgical drainage of the empyema cavity died of a suppurative pericarditis 96 days following thoracotomy. Necropsy revealed complete adherence of the pericardium to the anterior surface of the heart, multiple abscesses in the myocardium and a collection of purulent fluid in the posterior pericardial sac.

Empyema complicating pneumonia treated by one of the sulfonamide compounds runs an atypical and bizarre course. Lack of appreciation of this fact, and the tendency of this type of pleural effusion occasionally to persist for a prolonged period before becoming purulent, has resulted in many patients at the time of operation having a greatly thickened pleura, collapsed or partially collapsed lung, decreased mobility of the chest wall and a large empyema cavity.

The surgeon must bear this changing picture of empyema in mind and alter his previous indications for the opportune time to institute surgical drainage.

SUMMARY AND CONCLUSIONS

1. The early diagnosis and adequate surgical drainage of postpneumonic empyema thoracis complicating sulfonamide-treated pneumonia are essential to reduce the morbidity of this disease.

2. The character of the pus, the specific gravity of the effusion, and temperature readings are not reliable guides as to the optimum time for the institution of surgical drainage. Fluoroscopic study, following the aspiration of pus and replacement by a small amount of air so as to visualize diaphragmatic fixation, is an early and reliable guide for instituting surgical drainage. It is apparent that such fixation occurs early in the course of empyema complicating sulfonamide-treated pneumonia; that is, usually 18 to 21 days after the onset of the pleural effusion.

3. In this group of patients the hospital stay was prolonged because (a) the sulfonamide therapy used in the treatment of the preceding pneumonia and continued beyond the active pneumonic stage resulted in a delayed diagnosis of empyema and surgical drainage, and (b) lung reexpansion was definitely retarded in this group of patients.

4. Twenty-nine of the 31 patients whose pleurae were drained surgically have been restored to a duty status. Surgical drainage was done in a total of 31 cases with a mortality of 3.2 percent.

REFERENCES

1. BENSON, C. D., and PENBERTHY, G. C.: Review of fifteen years' experience with empyema in infants and children. *Ann. Surg.* 113: 1082-1083, June 1941.
2. BURFORD, T. H., and BLADES, B.: Influence of sulfonamide therapy on post-pneumonic empyema thoracis. *J. A. M. A.* 118: 950-952, March 21, 1942.
3. GRAHAM, E. A., and BERCK, M.: Principles versus details in treatment of acute empyema. *Ann. Surg.* 98: 520-527, October 1933.
4. BERMAN, J. K.: Nontuberculous empyema thoracis in children. *Surg., Gynec. & Obst.* 76: 183-188, February 1943.
5. ALEXANDER, J.: Pleural empyema. *Surg., Gynec. & Obst.* 77: 219-221, August 1942.



PSYCHOLOGY OF FEAR

Fear can make you a coward, or it can make you a hero. Whichever it makes you depends on whether you handle fear or let it handle you. If you handle fear correctly, it can become a powerful ally, helping you to behave adaptively and successfully in a dangerous situation. But if fear succeeds in handling you, it can destroy your usefulness as a fighting man. Fear can be mastered; it can be turned to useful ends.

There are very few instinctive fears, most of them are learned just as most likes and dislikes, habits, and attitudes. Newborn babies fear very few things—they must learn by experience and teaching. But why teach fear? Because most of our fears are handy things to have around. They represent successful adaptation to the potentially dangerous aspects of the environment in which we have to live.

Therefore, fear is a natural and very useful thing all of us experience from time to time. An individual who tells you he isn't afraid, particularly in or just before his first contact with the enemy, is either a complete liar or a case for the psychiatrist.

The first thing to do about fear is to expect it. You can count on its being there. And you can count on the enemy feeling the same way. There is no point in fearing fear. There is almost more point in fearing the absence of fear. Every man who has been exposed to action in this war—if he is honest—will tell you of the moments when he was afraid. But fear did not interfere with his fighting for he managed to acquit himself properly.

Knowledge is power over fear. The unknown is infinitely more to be feared than the known, and surprise is one of the most important elements in battle. People are more easily frightened by things they do not understand or do not expect. Actual objects and situations are seldom as bad as those the imagination can dream up. It is wise to know what to expect so that the enemy is unable to surprise you.

Courage is not the absence of fear, nor are the brave fearless. Courage happens when fear is controlled and the brave man is one who may be scared nearly stiff but still is capable of useful and necessary activity.—SANFORD, J. H., Lieutenant, junior grade H-V (S) U. S. N. R.

PRECISION BOMBING IN CHEMOTHERAPY

ALVIN F. COBURN

Commander (MC) U. S. N. R.

Science is now recognized to be playing a most important role in the strategy of modern warfare. Technics of attack which utilize instruments of precision are found invaluable in the air, on land, and at sea. The liquidation of key industries by precision bombing is proving a highly effective method for disrupting the war economy of an opponent. As a result, more and more attention is being directed to ways and means of attacking vital centers of production. The opponent's effectiveness in the attack or on the defense must depend upon his capacity to synthesize and utilize essential matériel.

A similar evolution of thinking is developing gradually in the minds of medical strategists. For centuries medicine was powerless to combat pandemics of bacterial infections, and only recently has it become possible to check attacks by the microbial kingdom. This achievement has resulted from two strategies "blueprinted" by two scientists, Pasteur and Ehrlich.

Pasteur's strategy involved the application of the principles of immunity. He described two technics whereby the host might either be protected against bacterial invasion or might overwhelm infecting microorganisms. Active and passive immunization have been signally successful in the prophylaxis and treatment of many bacterial diseases. However, the biochemical mechanisms whereby the fundamental physiologic processes of immunity destroy bacteria are in most cases completely unknown.

Ehrlich's strategy involved the utilization of chemicals which are bactericidal by virtue of their capacity to react with components of the bacterial cell. This principle has been successfully applied in the treatment of spirochetal infections. However, initial successes were followed by decades in which countless chemical compounds were made, tested and rejected. Years of trial and error failed to advance antibacterial warfare or to add anything to the knowledge of the mechanisms of chemotherapeutic agents, and by 1930 serious research based on Ehrlich's principles had almost ceased.

The current renaissance in chemotherapy owes its origin to the dye industry. The I. G. Farbenindustrie, in determining the effectiveness of dyes, tested the staining capacity of many compounds against bacterial cells. It so happened that one of the innumerable com-

pounds tested was an azo dye containing a sulfonamide group, the hydrochloride of 4'-sulfonamido-2, 4 diaminoazobenzene. This compound was found to inhibit cell multiplication. Modern chemotherapy stems from this observation (1).

Prior to this epic discovery, antibacterial agents were employed because they denatured proteins of bacterial cells (2). Since these agents were essentially protoplasmic poisons they also injured tissues of the host and for this reason their usefulness has been limited. Entirely new types of antibacterial substances are now being synthesized by the organic chemist or prepared from microbial cells. This evolution is shown in table 1.

TABLE 1.—*Types of chemotherapeutic agents*

Class	Protoplasmic poisons	Detergents, wetting agents	Animal products	Plant products	Microbial products	Sulfonamides
Examples...	Phenols, Mercurials, Arsenicals, Iodine, Acridine dye, Ultraviolet ray, etc.	Fatty acids, Duponal, Propylene-glycol, Incense, etc.	Lysozyme, Lactenin, etc.	Chlorophyll, extracts of onion, cabbage, etc.	Gramicidin, Tyrocidine, Penicillin, Actinomycin, Pyocyanase, etc.	P. A. B. plus acid radicals, Sulfanilic, Pyridine, Thiazole, Diazine, etc.
Mechanism.	Denature protein, oxidation, attack sulfhydryl groups, etc.	Alter surface activity.	Mechanisms not established.	Many mechanisms.	Many mechanisms.	Competitive inhibition of a key enzyme system.

The German discovery that an azo dye compound (prontosil) is an antibacterial agent was followed rapidly by the French demonstration that sulfonamide is the significant component and by British observations indicating that this molecule is bacteriostatic. The mode of action of this new drug stirred scientific curiosity, and the following findings were soon reported: (a) Sulfonamide is not a protoplasmic poison; (b) it does not make a culture medium unsuitable for growth; (c) it does not modify the cultural characteristics, the biochemical reactions or metabolism of the *resting bacterial cell*; (d) it does not modify the bacterial cell that has survived in a sulfonamide medium for sixteen hours or longer; (e) it does not modify bacterial multiplication during the first few hours of growth when essential requirements might be supplied by intracellular sources; (f) it *does prevent multiplication* of the bacterial cell during the logarithmic phase of growth when great demands are placed on the economy of the micro-organism undergoing rapid cell division.

The simplest interpretation of these observations is as follows: The bacterial cell contains a "vitamin" essential for multiplication. Its endogenous supply becomes exhausted in the early part of its growth cycle. To effect its logarithmic growth phase the micro-organism must synthesize this "vitamin." This it can do in a culture medium which ordinarily supports growth. However, the addition

of appropriate concentrations of sulfonamide interferes with the synthesis of substances essential to cell multiplication.

A search to identify this "vitamin" revealed that many apparently unrelated substances may relieve the strain on cellular economy created by sulfonamide during the logarithmic phase of growth. Some of these are peptone (3) and a factor in the hydrolysates (4) of gelatin, casein and egg albumen. The activity of these protein hydrolysates has been found referable to the combined action of certain amino acids, the monoamino monocarboxy, or so-called neutral amino acids, an example of which is methionine. These amino acids serve as a pabulum to the multiplying bacterial cell and protect the mechanism for multiplication against the bacteriostatic effect of sulfonamide. It is known that such sources of nitrogen shorten the "lag phase" in bacterial growth. Whether these sulfonamide antagonists function by accelerating growth, by stimulating the production of growth factors, by initiating the use of metabolic channels which bypass the need for para-aminobenzoic acid, or by some other mechanism not yet conceived presents an interesting, unsolved problem in nutrition.

Indications that cessation of bacterial growth in the logarithmic phase may be due to the specific inhibition of an important reaction exerted through interference with an essential metabolite or an intracellular enzyme system were strengthened by the observation that some of the sulfonamides affect the cozymase system of *Staphylococcus* (5) and the nicotinamide system of *Shigella* (6) (7). The important discovery by British bacteriologists (8) (9) that para-aminobenzoic acid is required for multiplication by the bacterial cell and that sulfonamides inhibit the synthesis or utilization of this essential growth factor indicated the mode of action of sulfonamide. Their studies suggested that the bacteriostatic action of all sulfonamides is explicable in terms of their structural similarity to para-aminobenzoic acid. It is now postulated that sulfonamide, by virtue of this similarity, competes with para-aminobenzoic acid for the prosthetic group of an enzyme system essential for multiplication of the bacterial cell. By replacing para-aminobenzoic acid, sulfonamide is believed to inhibit a key enzyme system and thereby interrupts microbial growth. Thus bacteriostasis appears to be effected by *competitive inhibition*.

Competitive inhibition is a well recognized phenomenon in medicine and in biochemistry. In carbon monoxide poisoning there is a competition between CO and O₂ for the iron of hemoglobin. If carbon monoxide is present in adequate concentration it competes successfully with oxygen and replaces oxygen in an enzyme system essential for respiration. A well recognized example of competitive inhibition in biochemistry is the competition between malonic and succinic acid for the succinic enzyme system (10). The succinic enzyme which ordinarily catalyzes the oxidation of succinic acid to fumaric acid is

inhibited by malonate. Under these conditions a malonic acid enzyme complex is formed which effectively blocks the oxidation of succinic acid to fumaric.

The reactions in these systems may be indicated schematically as follows:

System	Compound formed	Tendency of reaction
$\text{Fe}^{++} + \text{O}_2$ $\text{Fe}^{++} + \text{CO}$	Fe^{++}O_2 Fe^{++}CO	Dissociation Combination
Succinic enzyme + succinic acid Succinic enzyme + malonic acid	Fumaric acid Malonic acid Enzyme compound	Dissociation Combination
Unknown enzyme X + 1 P. A. B.	P. A. B. Enzyme X compound	Dissociation
Unknown enzyme X + 20,000 sulfanilamide	Sulfanilamide Enzyme X compound	Combination

It is suggested that the end product in each of the above examples is determined by the relative affinity of the competitors for the prosthetic group and that in the last example, para-aminobenzoic acid has a greater affinity for the X-enzyme system than any of the sulfonamides. Because of this, a relatively high concentration of sulfonamide is required to compete with para-aminobenzoic acid for the active combining group. However in each instance where firm combinations occur, the enzyme system is blocked. Sulfonamide appears to act like a log jam; it prevents the utilization of the para-aminobenzoic acid molecule, and it fails to perform any useful function in the economy of the bacterial cell. Elucidation of the exact mechanism of sulfonamide action must await the establishment of the identity of the X-enzyme. This will mark a major advance in the science of chemotherapy.

Practical application of the principle of competitive inhibition permits an evaluation of any new sulfonamide. For example, drug effectiveness may be tested as follows: *B. coli* is grown in a medium free of sulfonamide inhibitors. The quantity of sulfonamide required for bacteriostasis and the quantity of para-aminobenzoic acid required to reverse the sulfonamide effect are determined. The

P. A. B.: sulfonamide ratio required for reversal of bacteriostasis indicates the effectiveness of the drug (11) (4). The more para-aminobenzoic acid required for reversal, the more active is the drug. A sample protocol for *B. coli* grown in an inhibitor-free medium illustrates how the order of chemotherapeutic activity of a new sulfonamide may be determined:

Drug	Molecular weight	Micrograms of drug required for bacteriostasis in 5 cc. of basal medium	Order of chemotherapeutic activity	P. A. B.: drug ratio required for reversal
Para-aminobenzoic acid.....	137			
Sulfanilamide.....	172	75	1	1:1,600
Sulfapyridine.....	270	10	10	1:200
Sulfathiazole.....	271	1	120	1:10
Sulfadiazine.....	276	1	120	1:10

If this concept of competitive inhibition is applicable to the development of chemotherapy, it should be possible to build compounds structurally similar to essential "vitamins" and use them as bacteriostatic agents. This has already been accomplished in a number of instances. For example it has been demonstrated that the sulfonic acid analogue of pantothenic acid is bacteriostatic for organisms requiring pantothenic acid (12). Moreover, British investigators (13) have shown that pantoyltaurine, which is structurally similar to pantothenate, will suppress the growth of sulfonamide-fast streptococci if present in excess over pantothenate in the culture medium. In the rat, pantoyltaurine protected against 10,000 lethal doses of hemolytic streptococcus; this effect was reversible by the simultaneous administration of pantothenate. Similarly, pyrithiamine, the pyridine analogue of thiamine, inhibits the growth of many microbial species (14). This effect was observed only in those organisms which required thiamine or its components for growth, and the quantity of pyrithiamine necessary for inhibition was dependent on the thiamine requirements of the organism. Furthermore, characteristic changes of scurvy have been produced by feeding glucoascorbic acid, an analogue of ascorbic acid, to mice or cotton rats on a highly purified diet (15). This effect was reversible by adding antiscorbutic plant substances to the diet. Together these experimental findings indicate how a chemotherapeutic agent can be developed along rational lines. In each instance it was postulated that the analogue would act as a competitor for an essential growth factor and each prediction was verified experimentally.

A recent study representing the collaboration of organic chemist, biochemist and bacteriologist (16) has now clearly demonstrated the application of this principle to the evolution of chemotherapy. Thirty-five compounds related in structure to para-aminobenzoic acid were synthesized and their effects on the growth of hemolytic streptococcus,

pneumococcus and colon bacillus have been tested. Twelve compounds showed bacteriostatic effects which could be reversed by para-aminobenzoic acid. One of these compounds, 5-nitrothiopene-2 carboxylic acid, was highly bacteriostatic and reversed only by a relatively high concentration of para-aminobenzoic acid. It appeared from this study that the antibacterial action of these analogues was determined by the chemical reactivity of functional groups as well as by the similarity in physical dimensions of the molecules to para-aminobenzoic acid.

Competitive inhibition is only one of many mechanisms that can be utilized for "blueprinting" the construction of chemotherapeutic agents. Studies on the action of gramicidin (17) indicate that this bacterial polypeptide exerts a peculiar inhibitory effect on an essential step in the intermediary metabolism of gram-positive organisms. Identification of the gramicidin mechanism will probably lead to the synthesis of bactericidal polypeptides.

The importance of identifying the mode of action of a chemotherapeutic agent is illustrated by what is being accomplished through studying the action of antibiotics from other microorganisms. For example, it has been found that notatin (18), an antibacterial substance isolated from *Penicillium notatum* Westling, is a flavoprotein which catalyzes the aerobic oxidation of glucose to gluconic acid. H_2O_2 is produced by this oxidation, and it is to H_2O_2 that the bactericidal effect is attributed. It was predicted that if this concept is correct, it should be possible to achieve the same chemotherapeutic effect from H_2O_2 produced by the action of other flavoproteins. And this prediction has been verified recently by American investigators (19). Milk xanthine oxidase, a flavoprotein which catalyzes the aerobic oxidation of hypoxanthine and xanthine to uric acid with the production of H_2O_2 , has a striking bactericidal effect. Under appropriate conditions, traces of milk xanthine oxidase (final concentration in culture medium $1:10^8$) kills a wide variety of microorganisms. This demonstration indicates how the understanding of a chemotherapeutic mechanism may have practical application.

It is true that previous advances in chemotherapy seem to have occurred by chance and it is also true that the building of chemotherapeutic compounds which will disrupt an essential cellular enzyme system may not be practicable until medicine accumulates knowledge of the mechanisms of drug action and the synthetic processes of the microbial cell. However, results from fundamental studies of the past few years already indicate that, with further observations on the mechanism of antibacterial substances, chemotherapy can be developed along rational lines. The prosecution of successful warfare against certain important infectious processes may well depend upon evolutionary changes in the strategy of chemotherapy with less emphasis

on "random shelling" and an increasing concentration of effort on "precision bombing."

The author feels deeply indebted to Drs. R. West and D. E. Green of Columbia University and to Dr. R. J. Dubos of the Rockefeller Institute with whom he has been privileged to study the mode of action of chemotherapeutic agents.

REFERENCES

1. DOMAGK, G.: Ein Beitrag zur Chemotherapie der bakteriellen Infektionen. *Deutsche med. Wchnschr.* 61: 250-253, February 15, 1935.
2. DUBOS, R. J.: Microbiology. *Ann. Rev. Biochem.* 11: 659-678, 1942.
3. LOCKWOOD, J. S., and LYNCH, H. M.: Studies on mechanism of action of sulfanilamide; influence of proteolytic products on effectiveness of sulfanilamide. *J. A. M. A.* 114: 935-940, March 16, 1940.
4. Unpublished studies from the author's laboratory in the Department of Medicine at Columbia University.
5. WEST, R., and COBURN, A. F.: Relationship of sulfapyridine, nicotinic acid, and coenzymes to growth of *Staphylococcus aureus*. *J. Exper. Med.* 72: 91-97, July 1940.
6. McILWAIN, H.: Pyridine-3-sulphonic acid and its amide as inhibitors of bacterial growth. *Brit. J. Exper. Path.* 21: 136-147, June 1940.
7. DORFMAN, A., and KOSEB, S. A.: Mechanism of action of certain sulfonamide compounds. *J. Infect. Dis.* 71: 241-252, November-December 1942.
8. WOODS, D. D.: The relation of p-aminobenzoic acid to mechanism of action of sulphanilamide. *Brit. J. Exper. Path.* 21: 74-90, April 1940.
9. FILDES, P.: Rational approach to research in chemotherapy. *Lancet* 1: 955-957, May 25, 1940.
10. GREEN, D. E.: Mechanism of Biological Oxidations. Sixth edition. Cambridge University Press, 1940.
11. ROSE, H. M., and FOX, C. L., Jr.: Quantitative analysis of sulfonamide bacteriostasis. *Science* 95: 412-413, April 17, 1942.
12. SNELL, E. E.: Gross inhibition by N-(alpha, sigma-dihydroxy-beta, beta-dimethyl-buteryl) taurine and its reversal by pantothenic acid. *J. Biol. Chem.* 141: 121-128, October 1941.
13. McILWAIN, H., and HAWKINS, F.: Chemotherapy by blocking bacterial nutrients; antistreptococcal activity of pantoyltaurine. *Lancet* 1: 449-451, April 10, 1943.
14. WOOLLEY, D. W., and WHITE, A. G. C.: Selective reversible inhibition of microbial growth with pyrithiamine. *J. Exper. Med.* 78: 489-497, December 1, 1943.
15. WOOLLEY, D. W., and KRAMPITZ, L. O.: Production of a scurvy-like condition by feeding of a compound structurally related to ascorbic acid. *J. Exper. Med.* 78: 333-339, November 1, 1943.
16. JOHNSON, O.; GREEN, D. E.; and PAULI, R.: The antibacterial action of derivatives of analogues of p-aminobenzoic acid. *J. Biol. Chem.* 153: 37, April 1, 1944.
17. HOTCHKISS, R.: To appear in *Advances in Enzymology*. 1944, Vol. IV.
18. COULTHARD, C. E.; SHORT, W. F.; MICHAELIS, R.; SYKES, G.; SKRIMSHIRE, G. E. H.; STANFAST, A. F. B.; BIRKINSHAW, J. H.; and RAISTRICK, H.: Notatin; antibacterial glucose-aerodehydrogenase from *Penicillium notatum* Westling. *Nature, London*, 150: 634-635, November 28, 1942.
19. GREEN, D. E., and PAULI, R.: Antibacterial action of xanthine oxidase system. *Proc. Soc. Exper. Biol. & Med.* 54: 148-150, October 1943.

EVALUATION OF MICRAFORM SULFATHIAZOLE IN THE TREATMENT OF PARADENTOSIS (PYORRHEA ALVEOLARIS)¹

JOSEPH S. RESTARSKI

Lieutenant Commander (DC) U. S. N.

and

JAMES L. BRADLEY

Lieutenant Commander (DC) U. S. N.

A review of recent dental literature revealed no information concerning the use of micraform sulfathiazole for the local treatment of paradentosis. The local use of other sulfonamides is still controversial.

Edwards (1) states that sulfonamide therapy has not brought about discernible improvement in pyorrhea, and is apparently valueless in controlling this condition. On the other hand, Knebelman (2) reports successful use of sulfonamides in acute and chronic gingival infections. The Council on Dental Therapeutics (3) states that claims that topical application is of value are almost wholly inferential, and that further investigation, in which provision is made for adequate controls, is essential. Ostrander (4) concludes that no phase of sulfonamide therapy should be considered a closed subject. Further investigation of existing compounds and the introduction of new sulfonamides may change present theories and practices at any time.

In view of these diversified opinions a carefully controlled study was warranted. The sulfonamide chosen for the investigation was micraform sulfathiazole. It was believed that the minuteness of the micraform crystal (2 by 2 by 5 microns) would facilitate its dissolution and in turn increase its potency when put into the gingival pocket.

PROCEDURE

To evaluate the effectiveness of micraform sulfathiazole, eleven patients with various stages of paradentosis were selected for the study. The patients were made available by the Naval Dental School, National Naval Medical Center, Bethesda, Md. It is believed that the

¹ From Naval Medical Research Institute and Naval Dental School, National Naval Medical Center, Bethesda, Md.

etiologic factor in these cases was local irritation rather than systemic or metabolic disturbances.

Prior to medication the teeth were carefully scaled and polished, and overhanging margins of restorations were corrected. Each patient was given instruction in the use of the toothbrush and in the maintenance of proper oral hygiene. The initial measurements of the pocket depth were taken after scaling and before medication was begun. Final measurements were recorded after treatment.

An attempt to obtain accurate controls was made by treating the gingival pockets on the right side of the mouth with microform sulfathiazole, and the pockets on the left with an 8-percent solution of zinc chloride.

Microform sulfathiazole was applied with the aid of a 5-cc. syringe into the gingival pockets as many as twenty-two times. Correspondingly cotton packs saturated with the zinc chloride solution were placed firmly in the interdental spaces on the left side of the mouth. The sulfathiazole applications were made two or three times daily, and the zinc chloride once each day. Because zinc chloride packs were used, cotton packs impregnated with sulfathiazole were applied in some cases in order to evaluate the effect of the pack. The sulfathiazole packs were kept in position at least one-half hour, and the zinc chloride for about 10 minutes at each sitting.

The sulfathiazole was applied in the form of a thick paste made by the addition of a 25-percent glycerin solution to the dry powder. One-third sodium bicarbonate by weight was added to the powder to help maintain the alkalinity of the preparation while it was in contact with the tissue of the pocket, because it is known that sulfathiazole, although not inactivated by a lowered pH, is made insoluble (5).

A test of the blood for sulfathiazole, from 3 to 5 days after treatment was initiated, gave negative results in all cases.

RESULTS

In eleven cases of parodontosis, ranging from mild to severe, the most reduction of inflammation occurred when the patients were most diligent in maintaining good oral hygiene following scaling and polishing of the teeth.

Reduction in depth of the gingival pockets was more marked following medication with 8-percent zinc chloride than with microform sulfathiazole, as recorded by direct measurements before and after treatment. This reduction in depth was apparently due to the contraction of the pocket wall and not to reattachment of the tissue to the root, as shown in the accompanying table.

Case histories

Patient No.	Age	Sex	Clinical manifestations and etiology	Depth of pockets. A: After scaling, before medication; B: After medication
1	27	M	Hyperemia and swelling of gingivae; resorption of bone of alveolar crest; salivary and deep serusal calculus; neglect of oral hygiene.	A: 4-8 mm. in upper and lower molar regions; 2-3 mm., lower incisors. B: Microform sulfathiazole 17 applications. ZnCl ₂ 17 applications. No reduction in depth of pockets regardless of medication. Surgical resection of gums indicated. Continued poor oral hygiene.
2	45	M	Hyperemia of gingivae, particularly of interdental papillae; moderate resorption of bone of alveolar crest; heavy salivary and deep serusal calculus; neglect of oral hygiene.	A: 2 mm. average in upper and lower anterior; 3 mm. in upper and lower molar areas. B: Microform sulfathiazole 15 applications; ZnCl ₂ 15 applications; 2 mm. average reduction with ZnCl ₂ ; less with microform sulfathiazole. Oral hygiene, good.
3	22	M	Moderate redness of maxillary and mandibular interdental papillae; mild resorption of bone of alveolar crest in molar areas; small amounts of deep serusal calculus; oral hygiene, good.	A: 2-4 mm. (average depth). B: Microform sulfathiazole 10 applications; ZnCl ₂ 10 applications; 2 mm. average reduction with ZnCl ₂ ; less favorable with microform sulfathiazole. Oral hygiene, good.
4	39	M	Redness and swelling of interdental papillae, more marked in molar areas. Some resorption of bone of alveolar crest, more severe in molar areas; deep serusal calculus; oral hygiene, fair.	A: 2-5 mm. average in upper and lower molar areas. 2 mm. in anterior areas. B: Microform sulfathiazole 15 applications; ZnCl ₂ 15 applications; 2-3 mm. average reduction with ZnCl ₂ ; about the same with microform sulfathiazole. Oral hygiene, excellent.
5	36	M	Hyperemia and swelling of gingivae. Reduction of interdental molar papillae; moderate resorption of bone of alveolar crest in molar areas; heavy salivary and deep serusal calculus; oral hygiene, fair.	A: 3-4 mm. in upper and lower molar areas. B: Microform sulfathiazole 22 applications; ZnCl ₂ 22 applications; 2-3 mm. average reduction with ZnCl ₂ ; about the same with microform sulfathiazole. Oral hygiene, good.
6	34	M	Moderately mild hyperemia of interdental molar papillae; some resorption of bone of alveolar crest; deep serusal calculus; oral hygiene, good.	A: 2-3 mm. in upper and lower anterior areas; 4-5 mm. in upper and lower molar. B: Microform sulfathiazole 19 applications; ZnCl ₂ 19; 1-3 mm. average reduction with ZnCl ₂ . Less reduction with microform sulfathiazole. Oral hygiene, excellent.
7	33	F	Mild hyperemia and swelling of gingivae; involvement of interdental papillae more pronounced; slight resorption of bone of alveolar crest; deep serusal calculus; oral hygiene, good.	A: 2 mm. in upper and lower areas; 3 mm. in upper and lower molar areas. B: Microform sulfathiazole 15 applications; ZnCl ₂ 15. 1-2 mm. average reduction with ZnCl ₂ . Microform sulfathiazole not so favorable. Oral hygiene, good.
8	46	M	Hyperemia and swelling of gingivae; interdental papillae more affected; extensive destruction of bone of alveolar crest; heavy salivary and deep serusal calculus; oral hygiene, good.	A: 2 mm. average in upper and lower anterior areas; 5 mm. in upper and lower molar areas. B: Microform sulfathiazole 14 applications; ZnCl ₂ 14. Results, negative. Surgical resection of gums indicated. Oral hygiene, good.
9	43	M	Gingival hyperemia and swelling; extensive destruction of bone of alveolar crest; occasional discharge of pus; heavy salivary and deep serusal calculus; debris; oral hygiene, poor.	A: 3-4 mm. average in upper and lower anterior; 5 mm. average in upper and lower molar areas. B: Microform sulfathiazole 16 applications; ZnCl ₂ 16. Results, negative. Surgical resection of gums indicated. Oral hygiene, fair.
10	42	M	Hyperemia and swelling of interdental papillae; profuse bleeding under light instrumentation; extensive destruction of bone of alveolar crest; soft debris; heavy salivary and deep serusal calculus; oral hygiene, poor.	A: 3-4 mm. in upper molar area. 2 mm. in lower anterior area. 4-5 mm. in lower molar area. B: Microform sulfathiazole 11 applications; ZnCl ₂ 11. Results, negative. Oral hygiene, improved. Surgical resection of gums indicated.
11	35	F	Upper teeth missing; hyperemia and swelling in molar areas; less marked in anterior; deep serusal calculus; oral hygiene, poor.	A: 2 mm. in lower anterior area. 5 mm. lower left cuspid; 4-6 mm. in molar areas. B: Microform sulfathiazole 22 applications; ZnCl ₂ 12. Results, negative. Oral hygiene, fair.

REFERENCES

1. EDWARDS, R. W.: Dental uses of sulfanilamide. *J. Am. Dent. A.* 27: 1394-1397, September 1940.
2. KNEBELMAN, A.: Sulfanilamide in acute and chronic gingival infections. *Dent. Items Int.* 62: 716-720, August 1940.
3. COUNCIL ON DENTAL THERAPEUTICS: Annual report: Sulfanilamide. *J. Am. Dent. A.* 28: 820-825, May 1941.
4. OSTRANDER, F. D.: Sulfonamides in dentistry. *J. Am. Dent. A.* 30: 1829-1838, December 1943.
5. Fox, C. L.: Certain new considerations in local sulfonamide therapy. *Bull. New York Acad. Med.* 19: 661-662, September 1943.



DEMEROL

Demerol is characterized by three important properties: analgesia, spasmolysis and sedation. Of these, the first is therapeutically the most significant. The drug is not as effective as morphine, but exceeds the analgesic potency of codeine. A dose of 125 mg. is required to approximate the effect of 17 mg. of morphine. When given orally, it reaches its maximum analgesic effect in about one hour and remains active for several hours. For severe pain parenteral injection often proves more efficacious, but usually the oral route yields satisfactory results.

Demerol appears to counteract all types of pain, but its effectiveness varies with the origin of the pain. Those arising from visceral peritoneum, pleura and smooth muscles in general respond best, while skeletal and neurologic pains are more refractory. Labor pains are also depressed by the drug.—QUICK, A. J., and TATUM, A. L.: Comments on treatment. *Wisconsin M. J.* 43: 326, March 1944.



SHOCK AND INTERNAL TEMPERATURE

It seems that there is a tendency for a rise in internal temperature in shock, or at least for no fall. This is physiologically reasonable, for a cutaneous vasoconstriction is an early response in shock and results in diminution in heat loss, which may or may not be considered protective. This raised rectal temperature may have some bearing on the pulse rate in cases of shock, for a raised temperature causes an increase in pulse rate. Further, from the series there is to be noted a pronounced increase in the normal interval that exists between the rectal and oral temperatures; the average difference is 2.6° F. in cases of shock and 1.1° F. in controls. Application of heat to one patient who had been exposed to low temperature for nine hours after injury resulted in a rectal temperature fall to 97.2° F., presumably because the circulation into the cold parts of the body was opened up by the applied heat.—WRIGHT, R. D., and DEVINE, J.: Body temperatures in shock. *M. J. Australia* 1: 21-27, January 8, 1944.

KNEE INJURIES IN SERVICE PERSONNEL

JOHN H. ALLAN

Lieutenant Commander (MC) U. S. N. R.

and

JESSE T. NICHOLSON

Commander (MC) U. S. N. R.

During the period from June 1942 to September 1943 one hundred fifty-three patients with knee injuries exclusive of compound wounds received treatment aboard this hospital ship. Ninety-eight of these cases were hospitalized. Fifteen were received for convalescence following operative treatment elsewhere and 44 arthrotomies were done aboard ship. Fifty-five were treated as out-patients.

An analysis of these cases was undertaken in order to coordinate the following information:

1. At what age were knee injuries most prevalent?
2. What was the duration of symptoms before medical aid was requested?
3. To what extent were working activities necessitating the use of ladders, hatchways, small boats, etc., responsible for initial injuries or an activating cause of previous knee trouble?
4. What type of knee injury was sustained among Naval personnel?
5. What were the most diagnostic symptoms and signs differentiating lesions?
6. What was the most effective treatment?
7. What were the least traumatizing operative procedures for the knees requiring surgery?
8. What was the duration of disability in any particular lesion?
9. What type of knee surgery should be undertaken by front-line hospitals?
10. Was an interrupted convalescence necessitated by transfer from one hospital to another detrimental to the patient's convalescence?

General considerations.—In the series of the knee injuries which required hospitalization the age incidence was as follows:

Age	Cases
17-20	18
20-25	53
25-30	8
30-40	19

In the entire series there was little difference in the knee involved. There were 76 cases of involvement of the right knee and 75 cases

of injury to the left knee. Two patients showed involvement of both knees.

A history of injury prior to coming into the service was given in 35 of the 98 hospitalized cases. In the majority of these, the initial injury had occurred during activity in football and basketball, predominantly the former. All of these patients experienced intermittent recurrences of symptoms from the time of the initial injury until their hospitalization for treatment.

The duration of the symptoms is shown in table 1. It is apparent that two-thirds of the hospitalized patients had had symptoms for more than 1 month.

TABLE 1.—*Duration of symptoms*

Hospitalized cases		Out-patients	
Time	Number	Time	Number
1-8 days.....	17	1-8 days.....	22
1-4 weeks.....	13	1-4 weeks.....	7
1-12 months.....	30	1-12 months.....	12
1-2 years.....	13	1-2 years.....	6
2-10 years.....	25	2-10 years.....	8

Table 2 shows the precipitating injury. In the 55 treated as out-patients, 5 gave a history of original trauma prior to entry into the service and are not included in the table.

TABLE 2.—*Precipitating injury*

Hospitalized cases		Out-patients	
	Percent		Percent
Twisting or wrenching of knee.....	51	Twisting or wrenching of knee.....	36
Direct violence from fall with knee flexed.....	26	Direct violence from fall with knee flexed.....	35
Acute flexion as in squatting.....	8	Gradual (no injury).....	25
Parachute jumping.....	6	Acute flexion as in squatting.....	3
Shell explosion.....	5	Explosion below deck.....	1
Explosion below deck.....	2		
No history of trauma.....	2		

Surgical pathology.—On the 98 patients who were hospitalized for knee injuries, 59 arthrotomies were performed. Fifteen of these were done at other medical activities, but were brought aboard for convalescence or evacuation to a base hospital. The types of derangement and pathologic findings of the 44 arthrotomies performed aboard this ship are shown in table 3.

TABLE 3.—*Types of derangement and pathologic findings*

1. Meniscus derangements:	
Medial:	
Bucket-handle tears.....	14
Transverse and longitudinal tears:	
Anterior half.....	3
Anterior half with loose body attached to torn anterior cruciate.....	1
Posterior half.....	4
Posterior half with tear of anterior cruciate.....	1

TABLE 3.—*Types of derangement and pathologic findings*—Continued

1. Meniscus derangements—Continued.	
Medial—Continued.	
Hypermobile	2
Discoid	1
Lateral:	
Bucket-handle tears	0
Transverse and longitudinal tears:	
Anterior half (marginal)	2
Posterior half	0
Hypermobile	0
Discoid	2
Cyst	2
2. Osteochondritis dissecans	5
3. Calculi of indeterminate origin	3
4. Traumatic synovitis	2
5. Synovial cyst	1
6. Loose body attached to torn anterior cruciate	1

The total number of proved cartilage derangements was 32. Of this group, 26 involved the medial meniscus and 6 the lateral meniscus. Of the medial meniscus lesions, 14 cases presented a typical bucket-handle tear, 4 were tears of the anterior half, and 5 showed a lesion in the posterior half. Two were classified as hypermobile cartilages and one was a congenital discoid cartilage.

The lateral cartilage revealed no bucket-handle tears, and the two cases with anterior tears were of the marginal type.

There were 10 knees with loose bodies and these included 5 cases of osteochondritis dissecans of which 3 showed the typical defect in the lateral articular margin of the internal femoral condyle with loose body formation. In the remaining 2, the defect was present in the under surface of the patella.

There were three knees presenting loose bodies of undetermined origin. One subject showed evidences of osteoarthritic changes in both knees associated with the presence of loose bodies. In the left knee there were two smooth convex loose bodies and in the right knee there was one. The third contained a calcified body in the posterior joint space.

In two subjects there were partial tears of the anterior cruciate ligament with a calcified loose body attached by pedicle to the torn ligament.

In the 14 patients with proved bucket-handle tears, 8 gave histories of initial injuries before coming into the service, and most of these initial injuries were sustained in sports, notably football. The precipitating factor in the recurrence of symptoms in 11 of these cases was a twisting or wrenching violence to the knee. With the knee in the flexed position the femur was suddenly rotated inward while the lower leg remained in fixed abduction or external rotation. In 3 cases the symptoms were precipitated by squatting, a movement which involved a joint motion similar to the one described above.

Anterior tears of the medial meniscus were also inaugurated by mechanisms of twisting or squatting. The posterior horn lesions produced symptoms as a result of kneeling, squatting, or climbing ladders.

In 35 arthrotomies done for cartilage derangement, 6 of the patients did not give a history of an old knee-wrenching injury. These were diagnosed after their initial injury. At operation 4 proved to be cartilage lesions; 2 revealed only a traumatic synovitis.

The symptoms in each case of osteochondritis dissecans followed some months after a direct blow to the knee. No recognizable difference could be elicited in the mode of trauma producing a patellar defect from that causing a condylar defect. In one of these cases in which the defect was present in the lateral articular margin of the internal femoral condyle, the internal semilunar cartilage had been removed 3 years previously.

TABLE 4.—*Classification of nonoperated knees*

	Case
Sprain of internal lateral ligament.....	22
Traumatic synovitis.....	36
Prepatellar bursitis.....	6
Tear of internal lateral and anterior crucial ligament.....	4
Dislocations.....	4
Sartorius bursa.....	3
Acute synovitis (2 nonspecific, 1 luetic, 1 allergic).....	4
Chronic synovitis (foot strain).....	2
Hypertrophic arthrosis.....	2
Strain, posterior capsule.....	1
Strain, vastus lateralis attachment.....	1
Strain, internal hamstring attachments.....	3
Pellegrini-Stieda disease.....	3
Osgood-Schlatter disease (old).....	3

Symptoms and diagnosis.—The problem which every knee injury presents is whether or not there exists an internal derangement which requires surgical intervention. It has been the policy aboard this ship to treat all knee injuries very conservatively and operate upon only those that presented by history and physical findings evidence of internal derangement.

Thirty-six cases of traumatic synovitis lead the list of injuries which were not treated surgically. It is true that this diagnosis presumes the injury of no other structure than the synovial membrane. This diagnosis was made in the presence of a history of initial injury and in the absence of any clinical signs except effusion and general discomfort upon extremes of motion.

Acute synovitis with effusion arose spontaneously in four subjects. The cultures of the aspirated fluid in each case were negative. In one subject a focus of infection was uncovered in the tonsils and following their removal an elevated sedimentation rate returned to normal and there was symptomatic improvement in the knee joint. A second patient with a history of intermittent recurrences was regarded as allergic. The effusion subsided spontaneously and the subject returned to duty. A third had a syphilitic synovitis with a positive Kahn reaction in blood and spinal fluid. The cause of the synovitis in the fourth individual was not determined. It resolved in a few days and the patient returned to duty.

Severely pronated feet in two individuals with faulty weight-bearing lines produced a chronic synovial thickening of both knees accompanied by pain along the medial aspect of the joints.

Hypertrophic changes in the knee joints in two other individuals caused chronic synovial thickening. One of these subjects was particularly interesting. Although only 23 years of age the hypertrophic changes in both knees were allied to a chondroplastic condition which involved also his elbows, hips and knees.

The six cases of prepatellar bursitis occurred in response to direct trauma causing pain and the characteristic dome-like swelling over the lower half of the patella with discomfort upon flexion.

A tear of the internal lateral ligament in four subjects was associated with a tear of the anterior cruciate. In these knees in addition to the symptoms of injury to the lateral ligament there existed abnormal forward movement of the tibia and excessive internal rotation.

The three cases of posterior dislocation of the knee were verified by x-ray. They were accompanied by an injury to the posterior crucial ligament. In one a peroneal nerve paralysis was present.

Anterior dislocation of the knee occurred in one subject as a result of a torpedo explosion. The tibia was displaced forward and laterally. The dislocation was of 4 days' duration, and sensation beyond the upper half of the lower leg was absent. The pulsations of the anterior and posterior tibial and peroneal arteries were absent. The foot was gangrenous. A low-thigh amputation was done to permit the use of a lower leg prosthesis as it was believed the knee joint could not be restored.

The diagnosis of sartorius bursa was made in three subjects. Characteristically they had pain on squatting and crossing their legs. This pain was localized to the medial aspect of the joint below the rim of the tibial plateau and was associated with a palpable tender swelling.

Osteochondritis of the tibial tubercle appeared in three knees. The subjects had pain, tenderness and bony thickening in the region of the tibial tubercle with discomfort upon kneeling. X-rays verified a persistent Osgood-Schlatter disease.

Pellegrini-Stieda disease was diagnosed radiographically in three subjects. They complained of tenderness localized to the medial aspect of the knee with stiffness. All were associated with previous trauma and two were accompanied by hypertrophic changes in the joint.

Strain of the posterior knee joint capsule occurred in one subject. He complained of pain in the posterior aspect of both knees with exacerbation upon standing watches. The pain was relieved by elevation of both heels.

A torn medial meniscus was suggested by a history of inward twist of the femur upon the fixed tibia with immediate pain and locking of the joint, or, subsequent to a minimal twisting injury to the knee, a recurrence of pain and effusion with a feeling of weakness and instability as if the knee might give way. Five clinical features were diagnostic in the order listed. (1) The lack of complete extension of the knee as compared with the opposite knee. (2) Pain in the cartilage area upon extension of the tibia on the femur. (3) Localized pain, tenderness, and fullness to palpation over the offending cartilage. (4) Discomfort in the cartilage area upon movement of the tibia from the abducted to the adducted position. (5) Local pain elicited upon sharply rotating the tibia on the femur with the knee flexed. A lack of effusion in bucket-handle tears was almost a rule.

Anterior tears and hypermobile cartilages were associated with a click of the cartilage during full flexion of the knee under the superincumbent weight of the body as in squatting.

The two external cartilage tears accompanied a history of an abduction, external rotation strain of the femur on the tibia associated with effusion and local tenderness over the meniscus. Clinically the signs were the reverse of those elicited in the medial meniscus injuries. No differentiation clinically could be made between a discoid cartilage and a marginal tear of an external cartilage. Cysts of the cartilage were recognized by palpation of a mass which appeared at the lateral joint margin with the knee completely extended and disappeared beneath the lateral ligament when the knee was flexed.

In the cases of loose bodies, including osteochondritis dissecans, there was a history of locking and pain usually followed by effusion. Frequently the patient could localize the position of the loose body. The diagnosis in these cases was made radiographically.

Roentgenologic examination was made in all cases in which there was a history of trauma and in all cases in which surgical treatment was indicated.

Treatment—Nonoperative.—As stated above it has been the policy on this ship to treat knee injuries as conservatively as possible and to institute surgical treatment only in the presence of clear evidence of an internal derangement. Some of these cases were borderline and in such instances the knee was subjected to intensive exercise in order that its reaction might be noted and the lesion more clearly manifest itself. Despite these precautions, at operation two knees failed to reveal any pathologic changes except a traumatic synovitis. There are several suggestions to be stressed in the employment of conservative measures.

Aspiration.—In order to relieve pain and prevent distention of the capsule, aspiration was carried out in all cases of effusion and

the aspirated fluid cultured. Following aspiration a compression bandage was applied to prevent a recurrence of the effusion.

Immobilization.—Following aspiration a light plaster cast was applied in all cases of injured ligaments in order to prevent further strain and to facilitate healing. Immobilization was continued in most cases for 6 weeks.

Procaine injections.—Procaine hydrochloride injections were found to be efficacious in patients who had strains of tendinous attachments rather than in those with ligamentous sprains. Subjects with symptoms of recent occurrence were relieved following 2 to 4 injections of procaine. Two subjects with tenderness over the patellar tendon attachment showing an unhealed osteochondritis were relieved of their symptoms. The subject with strain of the vastus lateralis attachment and another with strain of the internal hamstring attachments responded to procaine injection. Procaine hydrochloride was tried in internal lateral ligament strains but resulted in only temporary improvement, so a plaster cast was used.

Physiotherapy.—Baking and massage to the thigh muscles were used in conjunction with the institution of quadriceps exercise. Baking and light massage assisted greatly in relieving an irritated joint; however, exercise of the quadriceps has been the most important factor in the management of an injured knee. Quadriceps setting exercises were started immediately to maintain this important stabilizing muscle. With subsidence of effusion the amount of exercise was increased to include flexion and extension of the knee against gravity and finally against resistance.

Posture.—This involved most particularly the correction of foot pronation in order to check unequal stress on the knee joint due to faulty weight-bearing lines.

Treatment—Operative.—Surgical treatment was indicated by the history of a recurring disability when clinical findings pointed to an internal derangement of the knee. Spinal anesthesia was used. With a tourniquet in place and the knee flexed, a short transverse incision was made extending from the medial edge of the patellar tendon medially for $1\frac{1}{2}$ inches just along the rim of the tibial plateau. A trap door incision was made in the capsule; the longitudinal limb was placed along the medial edge of the patellar tendon and the horizontal limb just above and paralleling the rim of the plateau. The L-shaped capsular flap was reflected upward allowing an oblique incision to be made below its fold in the thin portion of the synovial membrane, thus avoiding the fat pad. This exposure allowed adequate access to the anterior compartment. If complete excision of the cartilage was desired, a tenotomy knife was used subcutaneously behind the lateral ligament and the posterior rim of the cartilage was

freed. This exposure had two very definite advantages: (1) A minimal operative scar resulted as the incision was placed in natural skin folds, and (2) trauma to the extensor mechanism of the joint was avoided which permitted an early postoperative recovery of the quadriceps power.

In the presence of bucket-handle tears or a derangement in which there was a displacement of cartilage into the intercondylar notch, only the displaced fragment was exercised. In other words the tear in the cartilage was completed surgically by extending the tear through the attachment anteriorly and then posteriorly in like manner. This factor was of significance in effecting a short period of disability. Complete excision however was done in those cases of discoid, cystic, hypermobile cartilages and anterior or posterior tears.

The anteromedial incision was used in cases with loose bodies. This incision allowed exploration of the quadriceps pouch, dislocation of the patella laterally, and in the osteochondritis dissecans cases sufficient exposure to pick out easily the loose bodies and curet and drill the bone underlying the defect.

Postoperative treatment.—A compression dressing consisting of several layers of sterile absorbent cotton or sheet wadding was applied from midthigh to midcalf and secured by two circular bandages. The patient was put to bed with the extremity elevated on pillows. On the 2d postoperative day the patient was encouraged to move his ankle and toes and to raise his heel from the bed. On the 3d postoperative day the patient was allowed to be up and weight-bearing with the aid of crutches. If an effusion was present, it was aspirated on the 4th day. The sutures were removed on the 7th day and massage to the thigh muscles was begun. From the 7th to 14th days crutches were discarded and flexion and extension of the knee against gravity was instituted. Thereafter as rapidly as the condition of the knee, as judged by effusion, pain, complete extension and flexion beyond 90 degrees permitted, resistive exercises were started and increased until the patient was able to perform squatting exercises without difficulty. Climbing ladders as on shipboard was an additional exercise which proved an excellent substitute for the stationary bicycle.

FACTORS INFLUENCING PERIOD OF CONVALESCENCE IN OPERATIVE CASES

Type of incision.—In those cases which were followed from operation until discharge to duty, the transverse and the short medial oblique incisions resulted in a much shorter period of disability than did the medial parapatellar incision. In the former group the duration of disability averaged 15–20 days; in the latter group the disability averaged 25–30 days. The quicker recovery period is at-

tributed to the fact that the incisions employed interfered less with the extensor mechanism of the knee than did the more traumatizing parapatellar incision.

Postoperative effusion.—Twenty percent of those knees exposed by transverse incisions showed a postoperative effusion. Seventy-two percent of those knees exposed with median parapatellar incisions showed similar effusions. All the cases with postoperative effusion exhibited a longer convalescent period than those without postoperative effusions.

Operative technic.—In 14 cases of bucket-handle tears 3 patients had the entire meniscus removed. They averaged 22 days of hospitalization; 2 of these had a postoperative effusion. In the 11 cases where only the central or detached portion of the cartilage was excised in the manner indicated above, the disability period averaged 16½ days, and none had a postoperative effusion.

Structure involved.—It has been a general impression that *total* excision of an external meniscus customarily requires a longer convalescent period than *total* excision of an internal meniscus. This was substantiated by actual experience, as the disability in the former averaged 38 days and in the latter 32 days.

Pathologic condition.—The duration of disability was influenced also by the existing lesion. Bucket-handle tears responded exceptionally well and 18 days was the average period of hospitalization. Anterior and posterior tears in which the entire medial meniscus was removed averaged 24 days. Cysts of the external cartilage also averaged 24 days. The partial tears of the anterior cruciate with a calcified loose body required 23 days. In osteochondritis dissecans cases in which removal of a loose body with drilling and curettement of the defect was done, the patients returned to duty in an average of 27 days.

Cases not rehabilitated.—The 2 cases of traumatic synovitis in which no pathologic change except a chronic synovitis proved by histologic section existed, averaged 72 days of convalescence aboard ship. They were subsequently evacuated because of the persistence of fluctuant knees. In one of these cases a hypertrophied fat pad was partially removed. This was responsible for a postoperative hemo-arthritis necessitating several aspirations. Another patient who was not rehabilitated for duty in the combat area was the one showing hypertrophic changes in both knees associated with loose body formation. During convalescence a mental depression developed which necessitated his evacuation.

Knee surgery should not be undertaken in a front-line hospital if asepsis is difficult to maintain because of flies, dust, scarcity of water, or presence of cases with sepsis. Of the 15 postoperative knee cases received by this ship for convalescence 2 had stitch infections, 2 had

low-grade wound infections and 1 had a pyoarthrosis. None of the 15 patients completed convalescence on this ship but were evacuated to other medical activities.

SUMMARY

1. Fifty-five percent of the knee injuries occurred in patients between the ages of 20 and 25 years.

2. Thirty-three percent of the patients treated surgically had histories of knee injuries prior to entry into the service; sixty-seven percent had had symptoms for more than 1 month.

3. A twisting force to the knee was the most frequent source of trouble.

4. Traumatic synovitis, injuries to the internal semilunar cartilage, and sprains of the internal lateral ligament were the most common injuries encountered.

5. A diagnosis of a cartilage lesion was difficult immediately after the initial injury. A knee which showed no derangement gave a bad prognosis for operation, as did an accompanying psychoneurotic disturbance.

6. Procaine was efficacious in the treatment of muscular strains but not in ligamentous sprains about the knee. Conservative measures were most advisable until a definite diagnosis of a cartilage injury could be made.

7. The duration of postoperative convalescence was in proportion to the amount of surgical trauma. The removal of the displaced fragment of a fractured cartilage gave a shorter convalescence than when the entire meniscus was removed. Parapatellar incisions prolonged convalescence.

8. Early use of the quadriceps was imperative for a short convalescence. Repeated aspiration for postoperative effusion is recommended. Disability in acute synovitis averaged 16 days; in sprain of internal lateral ligament 6 weeks; following an arthrotomy 24 days.

9. At a front-line hospital where surgical facilities are limited and septic cases are numerous it is advisable to defer elective knee surgery.

10. It is inadvisable to transfer cases during convalescence from one activity to another. It is recommended that elective operation be done at the locality in which the entire period of convalescence can be controlled.

SURGICAL CASUALTIES OF AMPHIBIOUS WARFARE

L. KRAEER FERGUSON
Captain (MC) U. S. N. R.

In order to obtain a composite picture of the battle casualties of modern warfare in the South Pacific a review of 3,333 case histories has been made. These comprise all of the surgical patients received aboard a hospital ship for a 6-month period beginning when the first casualties came aboard from the offensive in the Solomons area. The patients were received from ships and shore stations and were divided as follows: Navy 1,229, Marine 1,598 and Army 506. Most of the Marine, Army and a few of the Navy casualties were a result of land operations, but the majority of the Navy patients came from sea battles. All but a few of the casualties resulted from direct enemy action, but cases are included which occurred owing to operational accidents in battle zones such as falling into landing boats, plane crashes, truck and jeep accidents, accidental gunshot wounds, etc. These figures do not include surgical cases such as appendicitis, hemorrhoids, and hernia which have no relation to battle areas.

Of the 3,333 patients in this group there were 12 deaths, a mortality of 0.36 percent or 1 death in each 275 patients. This figure represents only the mortality in battle casualties as seen aboard this ship, and since there is no way of estimating the mortality before the patients are received aboard or after they leave, this figure should not be taken as the over-all mortality rate in wounded patients from this area.

The causes of death were as follows:

Compound fracture, femur—shock.....	1
Gunshot wounds, abdomen.....	2
Burns.....	1
Gas gangrene, multiple gunshot wounds.....	5
Plane accident.....	1
Infected gunshot wounds (gas?).....	1
Bayonet wounds—pulmonary embolus.....	1

Of these, two patients with gas gangrene died shortly after coming aboard, one in 2½ hours and the other in 5 hours. The two patients with abdominal wounds came aboard 3 and 9 days after injury and died of peritonitis. There were two operative deaths in the above series, both of them from gas gangrene.

If the patients are reviewed according to the injuring factor the results are as shown in table 1. Shell and bomb fragments accounted for the wounds in most Naval casualties; the lacerations and contusions resulted from being blown against bulkheads and other parts of the ship in torpedo or bomb explosions.

TABLE 1.—*Types of injuries*

	Shell frag- ment wound	Bullet wound	Bayonet wound	Contusion and lacer- ation	Total
Navy.....	719	40	4	98	861
Marine.....	778	602	24	71	1,475
Army.....	152	266	4	30	452
Total.....	1,649	908	32	199	2,788

Land casualties were caused by grenade, mortar shell, naval shell, and bomb fragments in a little over half the cases, and in the others by rifle and machine gun bullets. The contusions and lacerations occurred from being blown from fox holes, or being struck by falling trees or rocks loosened by shells or bombs. If 124 cases with contusions are subtracted from the total, there were 2,664 cases with open wounds. No accurate attempt could be made to estimate the number of individual wounds, but if just the site of wounds is counted (arm, leg, chest—3 areas) there were 4,807 areas of the body in which wounds were observed, and the number of individual wounds must be more than double this figure (table 2).

TABLE 2.—*Wound sites*

	Sea	Land		Plane	
	Shell frag- ment	Shell frag- ment	Bullet wound	Crash	Battle
Scalp.....	89	55	28	5	1
Face.....	121	81	42	13	2
Neck.....	32	50	33	1	1
Shoulders.....	101	122	96	2	4
Arm.....	176	171	116	3	4
Forearm.....	83	75	73	3	2
Wrist.....	30	19	9	0	1
Hand.....	69	74	57	0	2
Fingers.....	45	38	27	0	3
Chest.....	103	153	95	3	2
Axilla.....	10	18	6	0	0
Abdomen.....	38	38	26	0	1
Loin.....	15	18	15	1	0
Back.....	105	84	26	2	1
Buttocks.....	77	94	47	2	0
Groin.....	14	6	4	0	0
Genitalia.....	14	11	8	0	0
Thigh.....	218	197	139	2	10
Knee.....	67	64	34	0	2
Leg.....	325	217	124	5	13
Ankle.....	37	21	21	0	1
Foot.....	78	90	106	0	2
Toes.....	14	7	17	0	0
Total.....	1,861	1,703	1,149	42	52

The wounds resulting from both naval and land warfare were predominately of the extremities. Naval patients were wounded in 1,861 various areas of the body. There were 504 wound areas of the upper extremity, and 730 of the lower extremity. Thus 1,234 or about two-thirds of the 1,861 wound areas were of the extremities.

In reviewing the wound sites of patients injured in land battles an attempt was made to see if there was any difference in the site of wounds produced by shell fragments and those produced by machine gun or rifle bullets. The results were as follows: Of patients injured by shell fragments, wounds were produced in 1,703 areas of the body (head, chest, arm, legs, etc.). Four hundred ninety-nine were found in the upper extremity and 596 in the lower. Thus 1,095 or 64 percent of the 1,703 wound sites due to shell fragments were in the extremities.

Wounds were produced by bullets in 1,149 areas; of these 378 were in the upper extremity and 441 in the lower. Thus 819 or 71 percent of 1,149 wound sites due to bullets were located in the extremities. It may be seen from a glance at the figures that the lower extremity is the area of the body most frequently injured. Of the 4,807 wound sites there were 327 involving the head and face, about 6.8 percent of the total. Chest wounds were observed 356 times, 7.4 percent of the wound areas. Not more than a third of these produced intrathoracic injuries. Wounds of the abdomen were encountered 103 times, about 2 percent of the total wound areas. It is quite probable that a fair percentage of patients with wounds of the head, chest, and abdomen never reached the hospital ship.

Of the 3,333 casualties there were 1,285 patients with fractures, of which 1,062 were compound and 223 simple. In other words 1 in every 3 of the battle casualties (38.6 percent) had a fracture, and as a matter of fact every third patient had a compound fracture (table 3). Of all the fractures 83.6 percent were compound. There were 2,788 patients with wounds and contusions and of these 46 percent or almost every other patient had a fracture. It must be stated again that these figures refer to patients treated aboard the hospital ship and may not reflect the true picture at the battle site, as many patients with minor wounds may not be admitted to the hospital and patients with severe fractures may die before they can be evacuated to this ship.

TABLE 3.—*Bones involved in 1,285 casualties with fractures*

	Compound fracture	Simple fracture		Compound fracture	Simple fracture
Face and head:			Vertebrae:		
Skull.....	25	2	Transverse process.....	1	10
Nose.....	12		Body.....	14	22
Malar.....	3		Spine.....	3	1
Zygoma.....	4	1	Pelvis:		
Maxilla.....	4		Pelvis.....	24	16
Mandible.....	45		Sacrum.....	1	1
Arm and hand:			Acetabulum.....	0	3
Humerus.....	112	9	Leg and foot:		
Olecranon.....	3	3	Femur.....	120	8
Radius.....	47	18	Patella.....	19	5
Ulna.....	38	6	Tibia.....	103	21
Radius and ulna.....	40	3	Fibula.....	37	23
Carpus.....	7	2	Tibia and fibula.....	79	20
Metacarpals.....	62	6	Os calcis.....	21	16
Fingers.....	108	1	Astragalus.....	9	2
Trunk:			Tarsus.....	29	3
Scapula.....	33	2	Metatarsals.....	82	9
Clavicle.....	15	11	Toes.....	53	1
Ribs.....	65	10			

Fractures of almost every bone in the body were encountered in this series as may be seen from table 3. Fractures of more than one bone were quite common, e. g., a patient with compound fractures of both femurs and one radius; femur and both tibias; femur, humerus, radius, etc. Many of the simple fractures were also of multiple bones, for instance, a patient from a cruiser who was blown against a bulkhead by a torpedo explosion had a dislocation of the humerus, and fractures of the clavicle, 4 ribs and the os calcis in both feet. There were 837 fractures of long bones, of which 703 were compound and 134 simple.

Of the fractures of long bones, 178 patients with casts and 12 with splints came aboard with satisfactory position of the fragments and adequate immobilization. In 443 cases, reduction of the fracture was necessary and casts were applied. An additional 61 cases were immobilized in plaster splints.

Of the 3,333 casualties, 364 suffered with burns, and of this number 261 had burns only and 103 had additional wounds. Burns were a prominent cause of Naval casualties. Of 1,229 Naval patients, 295 had burns; about 24 percent, or almost one in every 4 patients. In addition there were 10 Marines who had been on duty aboard ships, who were admitted with burns.

Sea battles with bomb flash or fires on ships were the cause of burns in 292 cases. Other accidental burns on ships were caused by powder explosions and so forth in 5 cases. There were 40 patients who suffered burns from accidents on land. Of these, 27 were burned by throwing gasoline on a small flame in an effort to light a fire, and 7 were burned by fires in crashed planes.

The burns were mostly of the exposed areas of the body, as might be expected. It may be seen from table 4 that the face, hands, fore-arms and arms were most frequently involved in burns occurring on

ships. The relatively high frequency of burns of the legs in shore casualties is due to the dangerous practice of using gasoline to start fires.

TABLE 4.—*Areas involved in 364 cases of burns*

	Burns on ships	Burns ashore		Burns on ships	Burns ashore
Scalp.....	12		Abdomen.....	3	3
Face.....	201	12	Back.....	55	8
Neck.....	30	4	Buttocks.....	20	2
Shoulder.....	34	2	Thigh.....	18	2
Arm.....	127	17	Leg.....	58	15
Forearm.....	113	5	Ankles.....	36	
Hand.....	213	9	Feet.....	12	
Chest.....	28	7			

We had an opportunity to observe and record the results in 342 patients in whom wounds had been sutured. In some cases it was possible to ascertain the time from injury to wound suture, and in others this information was not available.

The results of this study are shown in table 5. In 190 wounds sutured in from 1 to 6 days after injury good healing occurred. Wounds with only serum drainage were counted as good. The majority of these wounds were small, many of them through and through bullet wounds, such as are known to heal well even without sutures. In 152 cases the wound suture was not successful, the wound had to be opened because of infection and hematoma, and in some instances an attempt to close the wound under tension resulted in necrosis and a larger wound than before suture was attempted. Wound suture in compound fractures with subsequent application of a plaster cast produced some of the most severe infections with which we had to deal.

TABLE 5.—*Analysis of 342 sutured wounds*

Result	Time from injury to suture						Total
	Unknown		Within 48 hours		3 to 6 days		
	Good	Bad	Good	Bad	Good	Bad	
Scalp	11	5					16
Face	27	4	1		3		35
Chest	2	2	1	5		1	11
Abdomen	3	3	15	14		1	36
Neck	1	3		1		1	6
Amputation	5	4	1				10
Extremities	108	96	4	6	8	6	228
	157	117	22	26	11	9	342

Total successful sutures—190.

Total unsuccessful sutures—152.

Certain types of wounds may be sutured with good results. Wounds of the face, of which 35 were sutured, healed well in 31 instances, and

11 of 16 scalp sutures were successful. Of the abdominal wounds 18 healed well and 18 broke down completely, in many cases into the peritoneal cavity. In 8 of the wounds which healed well, no intestinal injury was found and in 2 only gastric perforation was found. There was only 1 abdominal wound that healed without infection in which there was a colon perforation.

In the 3,333 surgical casualties there were 10 cases of gas bacillus infection proved by clinical observation and culture. Of these, 5 died and 5 lived. Two of the patients died 2½ hours and 5 hours after coming aboard the ship. A third, upon whom an amputation had been performed, died 4 days after admission from gas infection of the stump. The fourth patient died 5 hours after a midthigh amputation. The fifth individual had a through and through wound of the thigh which had been sutured the day following his injury. He showed evidence of gas infection on admission to the ship the tenth day after injury and died 2 days later in spite of excision of the involved muscle, wide incision, and huge doses of antitoxin and sulfathiazole.

Of the 5 patients with gas infection who lived, 4 were treated by incision and drainage and 1 by amputation. Sulfathiazole or sulfadiazine was used locally and orally and large (60–100,000 units) doses of gas antitoxin were given intramuscularly.

In 11 additional cases, gas-containing pus was found in wounds and was often demonstrable in the x-ray. In none of these was the diagnosis of gas bacillus infection confirmed by culture. In 8 of these patients colon bacilli or streptococci were found on culture but no gas bacilli. Seven had compound fractures. All were treated by incision and drainage, sulfathiazole or sulfadiazine locally and orally. One of the 11 died.

Finally there were 10 patients who were said to have had gas bacillus infections. In 7 of these, amputations had been performed, 3 of them on the day following injury. None of these showed any evidence of gas infection while on this ship. In 2 cases the stump was closed at the time of amputation. One of these became infected and streptococci and colon bacilli were cultured from the pus.

All of the proved cases of bacillus infections, all the cases suspected of having gas infection, and all of the cases coming aboard who were said to have gas gangrene, were with one exception casualties resulting from land battles. This was a patient from a sunken cruiser who had a compound fracture of both bones of the lower leg. He is said to have had a gas gangrene, and a disarticulation of the knee was performed aboard one of the transports returning from the original landing at Guadalcanal. No cultures were made and experience has proved how difficult it is to distinguish between gangrene

due to vascular injury plus superimposed gas-producing pyogenic infection and true gas gangrene.

It is surely true that gas gangrene is seen almost exclusively in land casualties and only very rarely in casualties that occur on ships.

The problem of gas bacillus infection is not large in our experiences in the South Pacific area. In 2,664 cases with open wounds not including burns, there were 10 cases with a positive diagnosis, 11 suspected but not proved and 10 were said to have had gas gangrene. It is believed that the diagnosis is doubtful in at least half of the latter 2 groups. However counting all these 31 cases as cases of gas bacillus infection, the incidence is only 1.1 percent. On the other hand gas bacillus infections offer a very serious problem. Of the 12 deaths on this ship in 6 months, 5 were due to proved gas bacillus infections and 1 to a suspected but not proved gas infection.

Five major amputations were performed aboard the ship; all were midhigh amputations. Two were performed for gas gangrene, 2 because of infected stumps of traumatic amputations of the lower legs, and 1 for gangrene following an anterior dislocation of the knee of 4 days' duration.

In addition we received patients on whom the following major amputations had been performed: Forearm 10, arm 7, thigh 13, and leg 17. There were therefore 52 major amputations in 3,333 patients, an incidence of 1.56 percent.



TONIC ACTION OF STRYCHNINE

Strychnine is often used as the principal constituent of tonic mixtures. This custom is in part dependent on the belief that in therapeutic doses this drug has a beneficial action on the gastrointestinal tract, promoting the appetite, rendering the digestive processes more efficient, and thereby increasing weight and general well-being. Strychnine in virtue of its taste has the action associated with simple bitters which reflexly increases the appetite and the flow of gastric juice. Therefore, in order to determine whether strychnine has any effects other than those due to the taste the drug should be given parenterally.

From these investigations three positive findings emerge: this drug appears, first, to stimulate the fasting stomach to active contractions; secondly in some cases to hasten the emptying-time after a test meal; and, thirdly, to increase the volume and acidity of the fasting gastric juice. No evidence has been here adduced to indicate that the parenteral administration of strychnine leads to any improvement in the general condition of the patient.—ANDERSON, W. F.: Tonic action of strychnine. *Brit. M. J.* 1: 380, March 11, 1944.

RENO-URETERAL COLIC

IN THE SOUTH PACIFIC AREA

MCCLEERY GLAZIER

Lieutenant Commander (MC) U. S. N. R.

and

CLARENCE OLSON

Lieutenant (MC) U. S. N. R.

The relatively high incidence of reno-ureteral colic, with or without associated urinary tract symptoms, has been a common observation throughout the South Pacific Area. These patients are admitted to advance Naval hospitals or hospital ships with the following diagnoses: Renal colic, renal or ureteral calculus, acute pyelitis, acute cystitis, hematuria, and diagnosis of undetermined origin. It is therefore obvious that the clinical impressions of medical officers referring these cases vary considerably.

A study was made of all patients with ureteral colic admitted to this base hospital from 1 June to 31 October 1943. The purpose of this investigation was to determine the basic pathosis after investigation of the genito-urinary tract, to search for etiologic factors which could be responsible for the high incidence of reno-ureteral colic in this area, and to suggest treatment for these cases.

During this 5-month period there were 91 patients admitted to this hospital with symptoms referable to the genito-urinary tract. Reno-ureteral colic was the chief complaint in 30 cases, an incidence of 33 percent. Examination of the hospital records of these 30 cases revealed the following data:

1. Two had had previous episodes of similar colic.
2. The average length of time from the onset of symptoms to hospital admission was 10 days, maximum 32 days, and minimum 6 hours.
3. The right side was affected 18 times, the left side 12 times.
4. Lower urinary tract symptoms, such as frequency, burning, and dysuria were present in 18 cases (60 percent).
5. Hematuria was present in 23 cases (75 percent).
6. Chills and fever were present in 6 cases (20 percent).
7. Costovertebral angle tenderness existed in 16 cases (50.3 percent).
8. Remote foci of infection were observed in only 3 cases and evidence of associated vitamin deficiencies were not noted in any.

Routine admission urinalyses showed red blood cells in pathologic numbers in 19 cases (63 percent) and white blood cells in pathologic numbers in only 4 cases. The pH determinations and notations re-

garding crystalluria were done as part of the routine procedure in approximately one-half of this series. These cases revealed low pH determinations and the urinary sediment was rich in uric acid, urate, and oxalate crystals. The kidney urines taken were almost uniformly negative to culture, the pH was consistently low, and the specimens were rich in the crystals mentioned.

Excessive perspiration obviously reduces the urinary output. Under the average working conditions in this area, and especially in battle, there is a reduced fluid intake. These two factors, excessive perspiration and decreased fluid intake, result in a highly concentrated, highly acid urine. This normal physiologic process was reconfirmed by examining the urine of 100 consecutive patients admitted to this hospital. There were only 7 specimens yielding an alkaline urine. The average pH determination was 5.8 and the average specific gravity 1.025. The urinary sediment was uniformly rich in crystals of uric acid, urates, and oxalates. Sulfonamide crystals were not observed.

A plain film of the kidneys, ureters, and bladder was part of the routine investigation. Only 3 cases showed a single, small, opaque calculus, which was proved by further examination to be in the urinary tract. The remaining 27 cases failed to reveal opaque shadows or nonopaque filling defects by intravenous or retrograde pyelography. Only one of the 27 cases showed upper tract pathologic changes. This was a mild hydronephrosis and hydro-ureter without a demonstrable underlying pathologic condition, in a man who was admitted to the hospital 3 days following his original onset of pain. Intravenous urography or phenolsulfonphthalein excretion showed normal kidney function in all cases examined.

SUMMARY

Thirty cases of reno-ureteral colic are presented. These cases represent 33 percent of the urologic admissions to this Naval base hospital during a period of 5 months. Hematuria and costovertebral angle tenderness were the most common associated findings. Urologic investigation revealed a normal upper tract in 86.6 percent of these cases. Three cases showed single, small, opaque calculi. A mild hydronephrosis and hydro-ureter was demonstrated in one case, which was considered the result of temporary partial obstruction due to the passage of a small stone, or edema following the passage of crystals. Foci of infection, local or remote, and evidence of deficiency diseases were not impressive.

Urine findings in this area show a uniformly low pH determination, an increased specific gravity, and crystalluria, chiefly uric acid, urates and oxalates. Since these crystals precipitate in an acid urine, and in the absence of upper urinary tract pathologic changes in a high per-

centage of these cases, it is logical to assume that reno-ureteral colic usually associated with gross or microscopic hematuria and costovertebral angle tenderness is the result of the passage of minutely small, nonopaque calculi, a "shower" of crystals composed of uric acid, urates, and oxalates. Since calculi composed of uric acid and urates are nonopaque to roentgenography this would be consistent with the paucity of positive roentgen findings in this series of cases. The scarcity of evidence of temporary partial obstruction due to ureteral edema following the passage of a small calculus or "shower" of crystals, is explained by the prolonged period of time existing between the onset of symptoms and admission to the hospital.

Prevention of this condition among the armed services in this area is considered most difficult in view of the rugged conditions under which the men are working and fighting. The direct treatment, after excluding more serious upper tract lesions by complete genito-urinary investigation, should consist of alkalinization and hydration for those cases in which opaque or nonopaque calculi cannot be demonstrated, and in which investigation reveals a highly concentrated, acid urine with crystalluria. This treatment should continue after the man has been returned to a duty status. Those cases in which definite calculi are found should be treated according to the size, location and chemical constituents of the stone, with due consideration to constitutional and deficiency disease, remote and local infections.



CANCER OF THE STOMACH

Approximately one-third of malignant tumors are located within the stomach. There are more deaths from cancer of the stomach than from all malignant tumors of the lip, tongue, cheek, tonsil, pharynx, larynx, salivary glands, thyroid, male and female breast, ovary, uterine cervix and corpus uteri combined.

The responsibility for surgical cure lies as much or more with the physician engaged in general practice as with the surgeon. This leads to a discussion of early symptoms. Pain is the most frequent. Preceding the onset of actual pain are vague, indefinite symptoms which are the important ones for early diagnosis. These are indigestion, vague epigastric discomfort, intolerance for meat, sensation of fullness and eructation of gas or liquid and weight loss.

In physical examination the presence of a palpable epigastric mass does not rule out the possibility of successful gastric resection. A nodule in the umbilicus, the so-called "Sister Joseph's nodule"; a sentinel node in the left supraclavicular fossa or node of Courvoisier or pelvic deposits forming a structure called "Blumer's shelf"; these are physically demonstrable signs of extension of the cancer outside the confines of the stomach indicating that surgical cure is not possible.—SCHARNAGEL, I. M.: Cancer of stomach; early diagnosis, treatment and end results. *M. Woman's J.* 51: 17-20, April 1944.

AUTOPLASTIC SUTURES IN REPAIR OF INGUINAL HERNIA

GEORGE G. CHILES

Commander (MC) U. S. N. R.

and

HARRY F. LENHARDT

Lieutenant Commander (MC) U. S. N.

The principles of the Bassini, Halsted, and Ferguson operations for the cure of inguinal hernia are still considered sound; however, there have been many modifications in technic. Nearly all operations for repair of inguinal hernia provide for the complete removal of the sac and the reinforcement of the abdominal wall, yet they differ in the method of disposition of the cord. Many recurrences have been reported with these accepted procedures, and numerous suggestions have been advanced to reduce their number.

Discussing the cause of recurrence, Bloodgood (1) stated that the chief one, regardless of the type of hernia, was that the conjoined tendon was weak or obliterated, and the ordinary suture in the closure of the defect in the abdominal wall was not sufficiently strong to protect against recurrence in the lower angle, and further that the transplantation of the rectus muscle and its fascia was not a certain cure. Recurrence after the properly ligated sac is removed, usually is seen below the abdominal opening at the base of Hesselbach's triangle.

McArthur (2) (3), Gallie and LeMesurier (4) (5), and others have recommended the use of both living and dead fascial strips for the repair of inguinal hernia. They have proved by experiments and from microscopic specimens that autoplasmic suture heals and lives in situ; it is not absorbed and does not slough. It is therefore to be regarded as a transplant and not merely as a suture material.

Seelig and Chouke (6) contended that muscle sutured to fascia did not unite with it, but rather that an adhesion occurred which became attenuated under pressure. Another explanation (Russell (7)) was that the suturing of muscle was harmful, interfered with its function and predisposed to recurrence of the hernia. Koontz (8) repeated the experimental work of Seelig and Chouke in the thigh of a dog and found that there is normally a layer of areolar tissue between the fascia lata and the underlying muscles. By simply suturing fascia to muscle Koontz found the result to be the same as that described by Seelig and Chouke, but when the layer of areolar tissue was first removed the muscle became adherent to the fascia.

Rives (9) was of the same opinion and proposed three cardinal principles: (1) Muscle offers no considerable resistance to forces directed

perpendicular to its fibers; (2) muscle atrophies if deprived of its function; and (3) fascia must be applied directly over the defect. He therefore advocated the use of the Andrews imbrication operation. Babcock (10) in 1927 suggested the use of fascial covering of the pubic bone in operating for the radical cure of hernia. He first used a simple suture of chromic catgut but now prefers steel alloy wire.

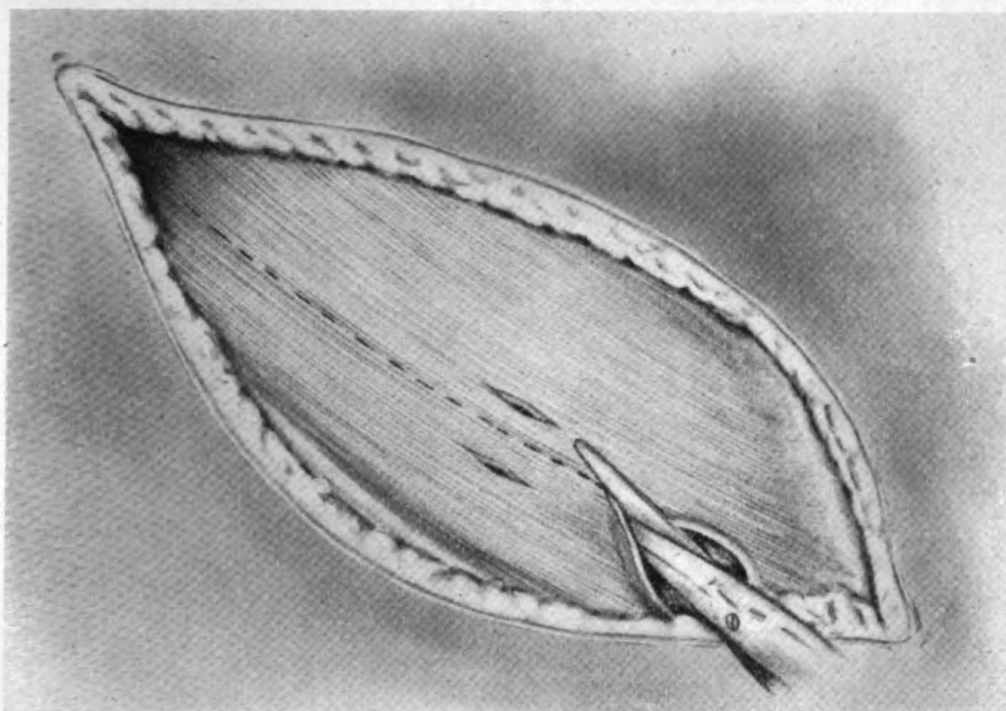
The study of the mechanism of hernia shows that the conjoined tendon is weakened or partially obliterated and that the fibers of the internal oblique and transversus abdominis muscles take a modified transverse direction toward the rectus sheath, leaving a defect of variable size. This defect is usually largest at the lower border of the rectus muscle, narrowing as it extends laterally, sometimes as far as the internal abdominal ring, causing weakness throughout the floor of the canal. Attempts at closure by the usual methods are not uniformly successful because the sutures will be placed under tension. The difficulty and inconvenience of securing the fascia lata, and the additional time consumed is perhaps the reason that the methods of Gallie and LeMesurier are not more commonly used. However, with the more recent advances in anesthesia, particularly with the use of continuous spinal anesthesia, the time element becomes unimportant.

The type of hernia repair advocated here is based on the technic of Robins (11) (12) who in 1938 reported his results with the use of autoplasmic sutures in hernia repair. Seelig (13) and Payne (14) have shown that the results obtained in the operation for hernia at the Mayo Clinic have improved with the introduction of autogenous fascial suture. There are two essential elements responsible for the success of the operation to be described: (1) Fascial sutures; and (2) the superior ligament of the pubis.

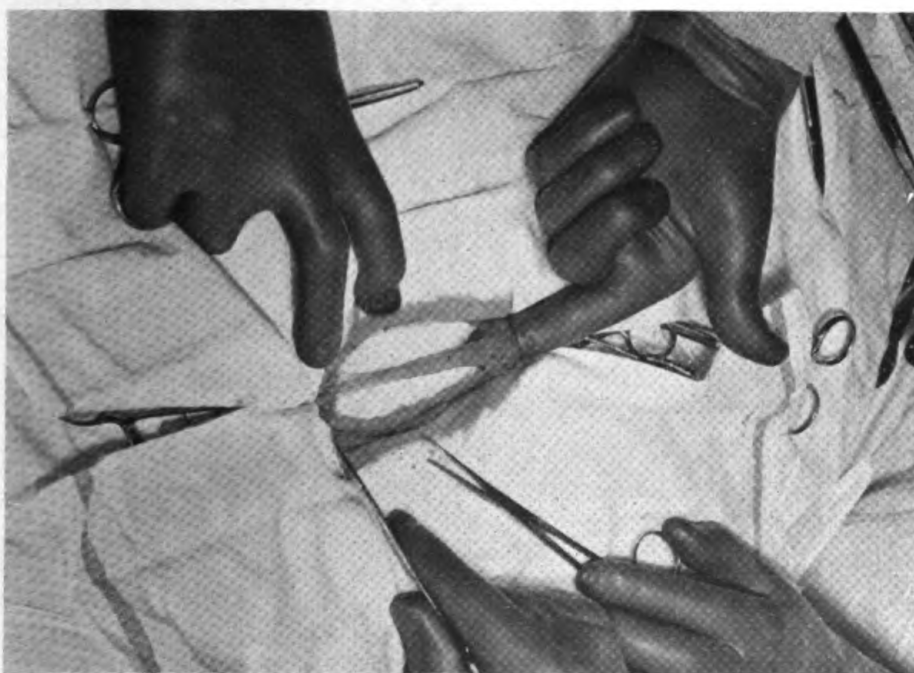
Operative technic.—Through a classical oblique incision for hernia the fascia and aponeurosis of the external oblique muscle are exposed and denuded of all superficial and areolar tissue. Strict hemostasis is observed throughout the operation. Adequate exposure of the longitudinal fibers of this fascia is facilitated by the aid of a gauze sponge over the surgeon's index finger.

The index finger is placed in the external ring so as to place the fibers on slight tension and to identify their course. Two small incisions (fig. 1) are made parallel to the direction of the fibers approximately 1 inch above the external abdominal ring through the fascia of the external oblique muscle and $\frac{1}{2}$ inch apart. These incisions are extended upward to the muscle and downward to the reflex ligament with a pair of scissors partly opened and pushed along without a cutting motion. The resultant fascial flap is separated from the underlying structures.

The circular fibers are cut at the apex of the external ring and the incision is extended upward, with the scissors midway between the



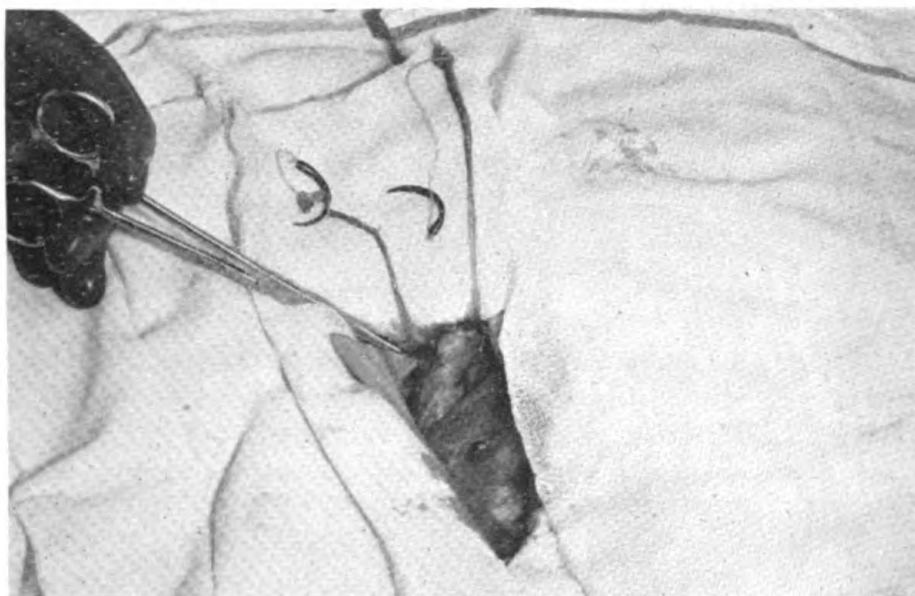
1. Showing the lateral incisions in preparation of the fascial sutures.



2. Showing the preparation of the two fascial sutures (just before cutting through external ring).

two lateral incisions, thus making two fascial sutures (fig. 2). The two flaps of the aponeurosis are then separated from the underlying structures exposing Poupart's ligament and the pubic tubercle to which it is attached. The external oblique fascia is exposed well beyond the border of the sheath of the rectus and down over the pubes.

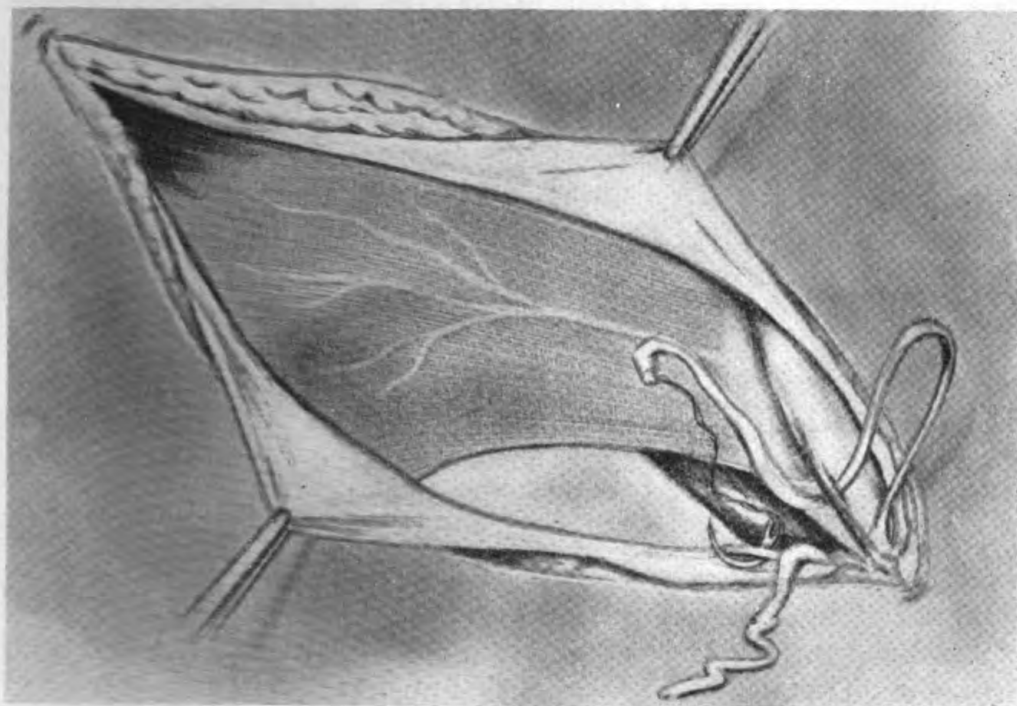
The hernia sac is next identified, dissected, ligated and excised. The medial fascial suture is severed above at the belly of the muscle and a double cotton suture on a needle passed through it at this point and securely tied. This cotton suture is then secured to a Gallie hernia needle (fig. 3).



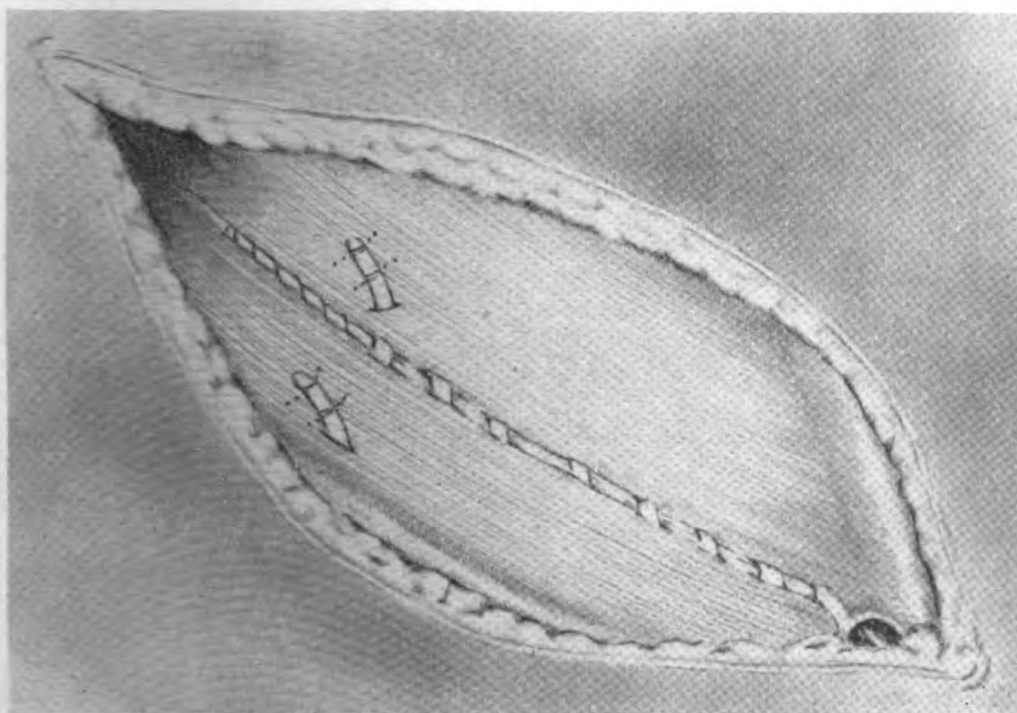
3. Showing the method of attachment of the Gallie needle and the length of the fascial sutures.

The glistening white fibers of the conjoined tendon are identified and exposed, using two Allis forceps. The cord is retracted and the Gallie needle passed through the reflex ligament and the superior ligament of the pubis and carried over the spermatic cord and vessels. A firm "bite" is taken in the fascia that covers the pubic bone at the pecten ossis pubis, care being used to see that the cord is not unduly compressed (fig. 4). The tip of the little finger is used as a gage for the opening of the new ring thus formed.

The next suture should incorporate Gimbernat's ligament, after which the continuous fascial suture approximates the conjoined tendon to the shelving margin of Poupart's ligament. Further continuation approximates the internal flat muscles and transversalis fascia to Poupart's ligament. The end of this fascial suture is secured with two interrupted cotton sutures on the external surface of the lateral flap of the external oblique fascia.



4. Showing the passage of the first sutures.



5. Showing the method of securing ends of fascial sutures.

The second or lateral suture is prepared in the same manner as the medial one. It is used as a continuous suture to approximate the two flaps of the external oblique fascia. This suture is passed over the cord to approximate the edges of the fascia at the pubic end, thus forming a new external ring. It is anchored on the external medial surface of the external oblique fascia with two interrupted cotton sutures (fig. 5). The remaining defect in the fascia at the upper margin of the wound is closed with interrupted cotton sutures. The margins of the superficial fascia and skin are approximated in the usual manner.

SUMMARY

The utilization of strips of living fascia as the suture material for the repair of inguinal hernia is advocated. The technic is based on the following points:

1. The careful separation and identification of the various abdominal layers will not only facilitate the operation but also allow the structures to fall into their new relationship after suturing.

2. Fascial sutures are resistant to infection; they do not tear and are not absorbed.

3. The stress or strain is not all on the terminal end of the suture, but it is applied after the principle of a windlass, being equally distributed throughout the course of the suture.

4. The existing pathologic condition should be the guide as to the type of repair to be used.

5. When for any reason the external oblique muscle is inadequate, the fascia can be secured from the fascia lata of the leg by the use of a Masson stripper.

REFERENCES

1. BLOODGOOD, J. C.: Transplantation of rectus muscle or its sheath for cure of inguinal hernia when conjoined tendon is obliterated. Transplantation of sartorius muscle for cure of recurrent hernia when Poupart's ligament has been destroyed. *Ann. Surg.* **70**: 81, July 1919.
2. McARTHUR, L. L.: Autoplastic suture in hernia and other diastases.—Preliminary report. *J. A. M. A.* **37**: 1162-1165, 1901.
3. *Ibid.*: Autoplastic sutures in hernia and other diastases. *J. A. M. A.* **43**: 1039, 1904.
4. GALLIE, W. E., and LEMESURIER, A. B.: Living sutures in operative surgery. *Canad. M. A. J.* **11**: 504, July 1921.
5. *Ibid.*: Living sutures in treatment of hernia. *Canad. M. A. J.* **13**: 469-480, July 1923.
6. SEELIG, M. G., and CHOUKE, K. S.: Fundamental factor in recurrence of inguinal hernia. *Arch. Surg.* **7**: 553-572, November 1923.
7. RUSSELL, R.: Inguinal hernia and operative procedure. *Surg., Gynec. & Obst.* **41**: 605-609, November 1925.
8. KOONTZ, A. R.: Muscle and fascia suture with relation to hernia repair. *Surg., Gynec. & Obst.* **42**: 222-227, February 1926.

9. RIVES, J. D.: Inguinal hernia: principles upon which its treatment is based. *Internat. S. Digest* 15: 3-13, January 1933.
10. BABCOCK, W. W.: Ideal in herniotomy; new method efficient for direct and indirect inguinal hernia. *Surg., Gynec. & Obst.* 45: 534-540, October 27, 1927.
11. ROBINS, C. R.: Direct inguinal hernia; presentation of operation for its cure. *Ann. Surg.* 108: 389-409, September 1938.
12. *Ibid.*: Personal communication.
13. SEELIG, M. G.: Fundamental principles underlying operative cure of inguinal hernia. *J. A. M. A.* 88: 529-532, February 19, 1927.
14. PAYNE, R. L.: Inguinal hernia: standardizing technique for operative repair. *South. M. J.* 27: 220-224, March 1934.



VITAMIN REQUIREMENTS AND TEMPERATURE

Vitamins are normally obtained in natural foodstuffs, and best growth response requires twice as much thiamin per kilo of food in tropical heat as in temperate coolness. It may be of interest to nutritional investigators that this actually calculates out to almost the same amount of thiamin per gram of weight gain in the heat and cold, due to the fact that food consumption in the heat is only 70 percent of that in the cold. So far as practical nutrition is concerned, however, it means that an individual in tropical heat must eat food twice as rich in thiamin if he wishes to cover his optimal requirements.—MILLS, C. A.: Letters to editor. *Nutrition Rev.* 2: 127, April 1944.



MORPHINE POISONING IN BATTLE CASUALTIES

When the peripheral circulation is sluggish or inactive, as it may be in patients who are chilled or who have low blood pressure, subcutaneous injections of drugs are poorly absorbed. This was frequently observed to be the case in the Italian campaign. Subcutaneous injection of morphine under such circumstances fails to relieve the pain of wounded men. Repeated injections, sometimes over a period of many hours, are not absorbed until finally by shock therapy and warmth, the circulation is reestablished in the skin and subcutaneous regions. The unabsorbed deposits of morphine, often totalling a grain or a grain and a half, are then taken up by the active circulation so rapidly that signs of morphine poisoning previously not present then appear, as shock is overcome.

It is usually stated that wounded men require large doses of morphine, doses that may be dangerously large. It is probable that this clinical tradition had at least part of its basis in poor absorption of the morphine in cases such as these. Although the intravenous use of morphine is desirable and would eliminate the problem, such use is not ordinarily practicable under field conditions. In this case, intramuscular injection followed by massage is the choice.—BEECHER, H. K.: Morphine poisoning in battle casualties. *M. Bull. North African Theater Operations* 1: 22-23, February 1944.

TEMPORARY STIMULATION OF EMMETROPIC VISUAL ACUITY ¹

JAMES E. LEBENSOHN

Commander (MC) U. S. N. R.

and

RAYMOND R. SULLIVAN

Lieutenant Commander H-V(S) U. S. N. R.

Repeated examinations of men eager to meet the visual standards of the armed forces have established that wide fluctuations in relative (or unaided) visual acuity are physiologically possible (1). The natural vision of ametropic persons has been improved by methods ranging from the Bates theory championed by Aldous Huxley (2) to viewing colored lights, flashing techniques, orthoptic training of all types, vitamin-A therapy, and cold hip baths (3). Visuopsychic excitation seems to be the only factor common to these procedures. An increase of interest, attention, and alertness effects keener interpretation of visuosensory stimuli. If this assumption is true, drugs that accelerate cortical or sympathetic activity should be similarly effective. This view is supported by recent experiments on one of the fundamental measurements of visual function, the fusion frequency of flicker. The more impulses a nervous center can perceive per unit of time, the better its functional state; therefore, the fusion frequency of flicker is indicative of the excitability of the visual system.

DRUGS AND VISUAL FUNCTIONS

Benzedrine and pervitin.—According to Simonson and Enzer (4) the fusion frequency of flicker declines during the working day parallel to the sense of subjective fatigue and cannot be voluntarily influenced. The experimenters found that the rate is noticeably increased by pervitin (desoxyephedrine), but more so by benzedrine (amphetamine). On the other hand, the endurance of motor centers, as evidenced by the tapping test, is more strongly affected by pervitin.

Benzedrine has both a central and peripheral action on the nervous system. The response is of prolonged duration and wears off gradually. The effective dose varies greatly according to individual susceptibility, probably depending on whether the subject is sympathicotonic or vagotonic. Central stimulation is independent of pressor effects and occurs with lower dosage (5). There is no correlation between euphoria and blood pressure. The respiratory rate remains virtually unaffected. Sargant and Blackburn (6) demon-

¹ Read before the Chicago Ophthalmological Society, 20 December 1943.

strated that after benzedrine has been taken there is an average increase of 8 percent in intelligence scores. They comment that, to be sure, there is no increase of intelligence; that the increase is in interest, alertness, ability to concentrate, ability to make decisions quickly, and in self-confidence.

Various visual effects have been noted. Benzedrine produces a temporary improvement in dark-adaptation (7) and prevents the binocular imbalance incident to sleepiness (8). After a 10-mg. dose, which is insufficient to affect blood pressure noticeably, the area of retinal angioscotomas is decreased (9). Oral administration has only a slight effect on the iris, the pupillary dilatation with a 20-mg. dose being about 0.3 mm.

The effect of certain other drugs on visual efficiency may be briefly considered:

Strychnine.—Strychnine has been regarded as a visual stimulant since 1821 owing to the persisting influence of uncritical clinical reports and discredited experimental data. Modern investigators, however, have found that strychnine has no influence on visual acuity, visual fields, dark-adaptation, color sensitivity, pupillary reaction, or the chronaxia of the optic nerve (10) (11).

Alcohol and sulfonamides.—After overindulgence in alcohol the visual acuity may fall from 20/20 to 20/40 or less (12). Sulfa drugs induce no significant change in visual acuity or accommodation, but occasion a disturbance of depth perception and ocular muscle balance especially for close vision (13).

Stimulant analeptics.—The depression produced by hypnotic drugs can be counteracted by the analeptics—picrotoxin, metrazol, or coramine. The depression is due to their stimulant action on the higher centers. Coramine, closely related chemically to niacin, is a powerful respiratory stimulant, and was selected by us for experimentation because it is relatively nontoxic and almost tasteless in dilute aqueous solution. A mild constriction of the pupil, increasing with the dose, accompanies its internal administration. The increased respiration perhaps exerts a favorable effect on visual sensitivity. Experiments on breathing room air at double the normal rate have shown that the visual threshold of the dark-adapted eye falls subsequently to about half the normal value within 10 minutes (14).

VALUE OF VISUAL STIMULATION

Interest in improving unaided acuity has been so far primarily to help ametropes pass the military requirements. This practice has had the deleterious consequences of circumventing established standards, of promoting the misconception that "eye training" can substitute for glasses, and of associating the issue of visual stimulation

with that of ametropic acuity. But the betterment of absolute acuity in emmetropes, or those made emmetropic by glasses, should have a useful significance. An increase of acuity above that attainable by a careful refraction would emphasize how much the psychic cortex participates in visual acuity measurements. The practical implications, particularly from the military standpoint, are obvious; for example, although men qualify for aviation or submarine duty with 20/20 acuity, it is advantageous to sharpen the vision further in periods of exceptional stress and responsibility.

PROCEDURE

In our experiments 50 men were selected for study whose visual acuity in each eye was 20/20 or better, naturally or with glasses. Acuity was tested on the double broken circles of the Ferree-Rand chart. This chart is the most accurate available and has the advantage of a refined grading for the higher degrees of visual acuity, the progression from 20/20 being 20/17.5, 20/15, 20/12.5, and 20/10. The unlearnable letter chart designed by Lebensohn (1) was used for timing the speed of vision. From a stop watch record of the 10-letter reading, the speed per letter in tenths of a second was noted and the average of 3 trials recorded. In every subject the eyes were examined separately and binocularly, so that each examination involved three tests for speed and acuity respectively. Each man was tested at 8 a. m. and was then given a placebo as a control, or 10 mg. of benzedrine, or 3 cc. of coramine, and the tests were repeated at 10 a. m. and 2 p. m. A few men from a section were examined each day with a view to making the entire group representative of healthy men ranging in age from 17 to 40.

TABLE 1.—*Stimulation of visual acuity*

Experiment	Test	Typical fast reader			Typical slow reader		
		Right eye 20/	Left eye 20/	Both eyes 20/	Right eye 20/	Left eye 20/	Both eyes 20/
Control	Visual acuity	/15.0	/15.0	/15.0	/20.0	/20.0	/20.0
	Speed per letter seconds	0.22	0.20	0.23	0.50	0.49	0.40
Coramine	Visual acuity	/12.5	/15.0	/12.5	/17.5	/17.5	/17.5
	Speed per letter { 10 a. m.	0.19	0.17	0.14	0.37	0.41	0.36
	{ 2 p. m.	0.17	0.20	0.16	0.34	0.34	0.34
	Visual acuity	/10.0	/12.5	/10.0	/17.5	/17.5	/17.5
Benzedrine	Speed per letter { 10 a. m.	0.18	0.16	0.13	0.31	0.31	0.32
	{ 2 p. m.	0.16	0.15	0.14	0.31	0.29	0.26

RESULTS

A consistent improvement in acuity and reading speed was induced by coramine and benzedrine in both slow and fast readers, as the typical examples in table 1 illustrate. Of the 50 subjects examined,

an improved visual response failed to occur in 17 after coramine treatment and in only 9 after benzedrine. Not infrequently improvement was manifest in one eye and not the other. This occurrence, which bore no relation to ocular dominance, may be attributable to the distribution of attention (table 2).

TABLE 2.—*Improved visual response to stimulating drugs*

Drug	Each eye and both eyes	One eye and both eyes	One eye only	Both eyes	No change
Coramine.....	18	11	3	1	17
Benzedrine.....	30	7	3	1	9

The value of these drugs in stimulating visual performance is well shown in the over-all average of the data given in table 3. For the right eye, for instance, the average visual acuity, which was 20/17.2 in the controls, improved to 20/15.9 after the administration of coramine, and to 20/14.4 after benzedrine; likewise the reading speed per letter, measured in sigma (thousandths of a second) increased from 358 in the controls to 274 after the administration of coramine, and to 245 after benzedrine. Comparison of the tests at 10 a. m. and 2 p. m. discloses that the stimulating effect of both drugs is prolonged, and that the afternoon performance in many cases, notably after coramine had been taken, was even better than that of the morning (table 4).

TABLE 3.—*Stimulation of visual acuity: Results of 50 cases averaged*

Experiment	Test	Right eye 20/	Left eye 20/	Both eyes 20/
Control.....	Visual acuity.....	/17.2	/17.4	/15.95
	Speed per letter (sigma).....	358	363	317
Coramine.....	Visual acuity.....	/15.9	/15.6	/14.45
	Speed per letter {10 a. m.....	313	301	268
	{2 p. m.....	274	271	239
	Visual acuity.....	/14.4	/14.5	/13.3
Benzedrine.....	Speed per letter {10 a. m.....	245	225	209
	{2 p. m.....	246	231	214

TABLE 4.—*Maximum stimulation of visual acuity*

Administration 8 a. m.	10 a.m. test	2 p.m. test	No difference
Coramine.....	8	37	5
Benzedrine.....	27	21	2

Coramine or benzedrine improve reading speed more than visual acuity but the benzedrine effect on both visual functions is more pronounced than the coramine effect (table 5). Analysis of 150 tests shows that in 44 cases benzedrine was relatively superior to coramine

in stimulating visual acuity, and in 126 cases in increasing reading speed.

TABLE 5.—*Effectiveness of coramine and benzedrine in stimulating vision:
Analysis of 150 visual tests on 50 cases*

Test	Drug	Improvement	Superior	No improvement
Visual acuity	Coramine	80	6	70
	Benzedrine	110	44	40
Reading speed	Coramine	134	11	16
	Benzedrine	142	126	8

Benzedrine apparently exerts a more beneficial influence on normal than on ametropic vision. Of 16 cases of ametropia in which acuity was tested by the approach method, in half a better record was achieved after benzedrine, the improvement varying from 1/20 to 4/20. All these cases were checked by the Ferree-Rand chart with comparable results. Cases with bilateral essential amblyopia observed in the out-patient department were given for a month $\frac{1}{2}$ grain thyroid mornings, with or without 5 mg. of benzedrine. A limited improvement in visual acuity occurred in children but in adults no significant change was noted.

CONCLUSIONS

Psychic acumen affects all visual subjective tests. Otherwise unexplainable changes in visual acuity, visual fields, and visual adaptation can be correctly interpreted only on the basis of this conception.

The psychogenic origin of many visual complaints is probably insufficiently appreciated. The visuopsychic cortex can be stimulated by various measures, but benzedrine in small doses (from 5 mg. to 10 mg.) is a simple, safe and efficient agent for this purpose.

REFERENCES

1. LEBENSOHN, J. E.: Visual rating, and presentation of improved unlearnable letter chart. U. S. Nav. M. Bull. 41: 744-749, May 1943.
2. HUXLEY, A.: The Art of Seeing. Harper & Bros., New York, 1943.
3. STEINHAUS, A. H., and KELSO, A.: Improvement of visual and other functions by cold hip baths. War Med. 4: 610-617, December 1943.
4. SIMONSON, E., and ENZER, N.: Effect of pervitin (desoxyephedrine) on fatigue of central nervous system. J. Indust. Hyg. & Toxicol. 24: 205-209, September 1942.
5. BLOOMBERG, W.: Effects of benzedrine in altering mental and emotional processes. Ass. for Research in Nervous and Mental Diseases 19: 172, 1937.
6. SARGANT, W., and BLACKBURN, J. M.: Effect of benzedrine in intelligence scores. Lancet 2: 1385-1387, December 12, 1936.
7. YUDKIN, S.: Vitamin A and the dark-adaptation; effect of alcohol, benzedrine, and vitamin C. Lancet 2: 787-791, December 27, 1941.

8. KLEITMAN, N., and SCHREIBER, J.: Sleepiness and diplopia. *Am. J. Physiol.* **129**: 398, 1940.
9. ROSENTHAL, C. M., and SEITZ, C. P.: Alterations in angioscotomas following oral administration of benzedrine sulphate. *Am. J. Ophth.* **23**: 545-549, May 1940.
10. FILEHNE, W.: Zur Beeinflussung der Sinne, insbesondere des Farbensinnes, und der Reflexe durch Strychnin. *Arch. f. d. gesamte Physiologie* **83**: 369, 1901.
11. SCHLAGINTWEIT, E.: Ueber Strychninwirkung auf die Sinne, insbesondere auf das Auge. *Arch. f. exp. Path.* **95**: 104, 1922.
12. NEWMAN, H., and FLETCHER, E.: Effect of alcohol on vision. *Am. J. M. Sc.* **202**: 723-731, November 1941.
13. REYNOLDS, F. W.; EVANS, M. S.; and WALSH, F. B.: Chemotherapeutic prophylaxis with sulfonamide drugs; effect of small doses of sulfathiazole or sulfadiazine on visual efficiency. *Am. J. Syph., Gonorr. & Ven. Dis.* **27**: 2-14, January 1943.
14. WALD, G.; HARPER, P. V., Jr.; GOODMAN, H. C.; and KRIEGER, H. P.: Respiratory effects upon visual threshold. *J. Gen. Physiol.* **25**: 891-903, July 1942.



TIME INTERVAL IN TAKING OF TEMPERATURES

The character of the rise of the mercury column in an oral thermometer under clinical conditions is different from that under laboratory conditions.

In this study, thermometers marked with specific time designations "1 minute," "½ minute," and "60 seconds" were found to require about the same length of time for the instrument to reach equilibrium as thermometers with no time designations.

Three minutes should be the minimum time interval allotted for an oral thermometer to reach equilibrium under ordinary conditions of use.—DE NOSAQUO, N.; KERLAN, I.; KNUDSEN, L. F.; and KLUMPP, T. G.: Clinical use of oral thermometers; report of study to determine time required for reliable registration. *J. Lab. & Clin. Med.* **29**: 179-184, February 1944.



PAREGORIC AS EXPECTORANT

Paregoric increased the output of respiratory tract fluid in albino rats, cats, rabbits, guinea pigs, and hens.

If the results of these experiments may be applied to man, they provide laboratory evidence justifying the centuries-old use of paregoric in the treatment of dry, hacking coughs. Because of its marked expectorant action paregoric is superior to morphine, which has probably no expectorant action, and to tincture of opium which has very little expectorant action. Paregoric is expectorant by virtue of a reflex from the stomach. Preparations of paregoric which have aged for two or three years are superior as an expectorant to preparations aged for less time.—BOYD, E. M., and MACLACHLAN, M. L.: Expectorant action of paregoric. *Canad. M. A. J.* **50**: 338-344, April 1944.

COSMETIC OCULAR REHABILITATION

MARVIN J. BLAESS

Lieutenant Commander (MC) U. S. N. R.

In recent years new materials and new methods have been developed and adapted to the making and fitting of artificial eyes. As a result of the progress that has been made there are available today a variety of types of ocular prostheses designed to meet the many different conditions requiring cosmetic ocular rehabilitation. Circumstances under which an eye may become unsightly, mutilated, partially destroyed, lacerated, shrunk or completely removed have been aggravated because of the industrial and combat conditions engendered by war. Hence a knowledge of the applicable surgical procedures, as well as familiarity with the prosthetic materials available, and an understanding of the conditions in which they may best be used are of greatest importance to ophthalmic military surgeons. The methods and materials used should be selected in accordance with the highest degree of suitability in each case. The cosmetic result obtained will depend greatly upon the knowledge, experience, and judgment used in this selection.

Formerly there were two types of glass prostheses available; namely, reform and shell. A reform prosthesis is a hollow sphere with the posterior surface invaginated so as to make a concave surface to conform to the stump and to fill in the space between the stump and the eyelids. A reform prosthesis is fitted by selecting a size that conforms to the individual's palpebral fissure and fills the socket sufficiently to hold the lids in as natural a position as possible. The size of the cornea and the color of the iris are matched with those of the remaining eye.

A shell prosthesis has a single thickness made in the form of the anterior portion of an irregular hollow globe having the general contour of a human eye. It is used when the space in the socket is limited or occupied by remnants of an eye. It is sometimes fitted over a mutilated or shrunk globe that has not been removed, or over a shrunk, eviscerated globe.

It is not the purpose to discuss here the indications for removal of an eye or the expediency of evisceration of the ocular contents, but to emphasize the surgical and anatomic conditions which are necessary to take the fullest advantage of the best types of prostheses available today.

There is surprisingly little difference of opinion among ophthalmic surgeons regarding the most advisable surgical technic. The matter of enucleation versus evisceration is not of primary importance in so far as the fitting of a prosthesis is concerned as long as certain fundamental factors are recognized. These factors are the anatomic filling of Tenon's capsule with the most suitable material, the proper regard for the anatomic position, and the functional importance of the conjunctiva, recti muscles, and orbital tissues. Many surgeons agree that ideal conditions for the fitting of a prosthesis exist when the globe has been enucleated, an implant of proper size and of suitable material has been inserted into Tenon's capsule, and the recti muscles, conjunctiva, and capsule have been replaced in their approximate anatomic positions. The preservation of as much conjunctiva as possible is necessary to obtain a socket adequate in size to receive the prosthesis. The filling of Tenon's capsule and the proper suturing of the recti muscles are necessary to give the stump the greatest possible motility.

Allport pointed out many years ago that enucleation with implantation into Tenon's capsule is indicated whenever evisceration with implantation into the scleral shell is applicable and also is the operation of choice in much lacerated and in shrunken eyeballs, and when sympathetic or neoplastic disease is present. Spaeth favors enucleation over evisceration. Torok and Grout do not favor evisceration and warn of the dangers of sympathetic ophthalmia following this procedure. Weiner and Alvis state the result of evisceration is not as good as that gained by enucleation with an implant in Tenon's capsule.

Weeks was of the opinion that enucleation with an artificial implant in Tenon's capsule provided for better movement of the artificial eye and prevented the occurrence of sinking of the upper eyelid, thereby affording excellent cosmetic results. Clapp stated that the best base for an artificial eye is that produced by the implantation of some foreign material in Tenon's capsule, arranging the ocular muscles in such a manner that motion may be imparted to the implanted foreign body. De Schweinitz wrote that "An enucleation which pays no attention to the preservation of the relationship between the conjunctiva, ocular tendons and capsule of Tenon, is a brutal operation which should not be performed unless the disease of the globe and surrounding orbit is of such a character as to render this precaution impossible." And Wheeler pointed out that omission of an implant into Tenon's capsule leads to disappointing results. The contraction of the orbital tissues in such cases leads to a sinking back and tilting of the artificial eye, while the lower lid sags and the upper lid becomes retracted just under the orbital arch. These changes not only create an unsightly appearance but often interfere with the drainage of

tears into the displaced lacrimal duct and lead to an annoying epiphora.

To avoid these disappointing results and to provide for the satisfactory appearance and function of an artificial eye an implant in Tenon's capsule is of utmost importance.

For implantation into Tenon's capsule many authors have advised the use of spheres, or objects of various other shapes, of glass, gold, platinum, alloys, bone, fat, plastic materials and other substances. In recent years surgeons have been showing considerable interest in tantalum. The peculiar property of this metal, which permits fibroblastic cells to grow onto it with subsequent tissue attachment to the metal, seems to indicate that this element should be the ideal material for implantation into Tenon's capsule.

If the insertion of an implant is not feasible at the time of removal of the globe, the recti tendons should be drawn together and included with Tenon's capsule and the conjunctiva in a Würdemann's purse-string suture. This will facilitate the insertion of an implant into Tenon's capsule at a subsequent operation.

The presence of an implant in Tenon's capsule in cases in which the entire globe is removed is therefore of utmost importance in so far as the fitting of a prosthesis is concerned, as it is essential in providing for a high degree of excellence in the fitting of the prosthesis. The presence of an implant permits the artificial eye to hold the lids in a natural position, avoiding to a large extent the sunken or depressed appearance often noted when an implant is not used. The fitting of a prosthesis over an implant also provides for a greater range of motion. The implant fits into the concave posterior surface of the reform type of artificial eye with a cushion of tissues between creating a certain degree of vacuum. This vacuum provides for the firm adhesion between the tissues and the prosthesis, allowing a satisfactory range of motion and aiding in holding the prosthesis in a natural position.

In recent years successful efforts to replace the types of glass artificial eyes with those made of plastic material have resulted in very gratifying progress in the cosmetic rehabilitation of unsightly, injured, and diseased eyes. Such plastic eyes are nonshatterable. They will not break if dropped. They are not chemically affected or discolored by the secretions of the eye socket. The surface of a plastic eye will maintain an oily film which permits free movement of the lids and prevents the drying of the secretions between the prosthesis and the lids with subsequent adherence and limitation of motion of the latter.

Of far greater importance, however, is the fact that plastic eyes are made from impression molds. This permits the artificial eye to be made to fit with anatomic accuracy the exact size, shape, and contour of each individual socket. Even in a total evisceration of the orbit

a large globe-like reform eye can be made to fill the entire epithelial-lined socket. In other special cases combination shell and reform eyes can be made to conform to different portions of the same socket.

In addition to the remarkable plastic prostheses for eyes that have been entirely lost it is also possible to fit contact lenses over unsightly but quiet blind eyes which have not been removed. In certain other cases the objectionable appearances caused by deformities of the lids and anomalous positions of eyes due to paralysis or blindness can be cosmetically corrected by contact lenses molded to the exact anatomic contour of the anterior global surface and with an iris reproduced exactly from a color photograph of the good eye.

Since the surgeon has at his disposal these several means, and a variety of types of ocular prostheses, it is important for him to select the method of cosmetic rehabilitation most suitable in each case. A blind eye need not be removed unless there are definite surgical, pathologic or cosmetic indications for removal. The surgeon should bear in mind his responsibility in providing the optimum conditions for fitting a prosthesis when he arrives at the decision to advise the removal of an eye.



CIRCULATION TIME IN CARDIAC DISEASES

The circulation time is prolonged in early failure of the left side of the heart (sometimes up to 45 seconds or more); in failure of the right ventricle; in mediastinopericarditis and pericardial effusion (hypodiastolic failure). Digitalisation reduces the circulation time. In well-compensated valve lesions or hypertension, angina pectoris and arrhythmia without heart-failure, the circulation time is normal. The value of the measurement of the circulation time in differential diagnosis of failure of the left heart and pulmonary affections is obvious. The circulation time is normal in bronchial asthma, prolonged in cardiac asthma. Dyspnoea due to compression of the trachea or bronchi, dyspnoea and cyanosis in emphysema (without heart-failure), and pneumonia have a normal circulation time. It is helpful in deciding whether oedema of the legs, ascites or enlargement of the liver is due to right heart-failure. Thyrotoxicosis, fever and anaemia may shorten the circulation time, and so make recognition of early heart-failure difficult. In congenital interventricular septal defects the circulation time is shortened. In one-sided pneumothorax the circulation time can be very fast, because the heart has to maintain the minute volume through the uncollapsed lung. Measurement of the circulation time may be a help for observing improvement in a case of heart-failure, for the circulation time may diminish before oedema and dyspnoea have disappeared.—DURAS, F. P.: Measurement of circulation time with saccharin. *Lancet* 1: 303-304, March 4, 1944.

APPLICATION OF CAUDAL ANESTHESIA TO GENERAL SURGERY

WILLIAM McKINLEY RUSSELL

Commander (MC) U. S. N. R.

and

JAMES E. CONLEY

Lieutenant (MC) U. S. N. R.

With the impetus given the caudal approach for obstetric anesthesia by Hingson, Edwards, and others (1) (2) (3) (4), its utility for general surgery in a Naval dispensary was tested. The results have been entirely satisfactory in cases requiring a saddle-type distribution regional anesthesia. In our dispensary the caudal approach seems to have filled a need for a safe and simple anesthesia for the many minor operations that attend military practice. It is not contended that this article contributes any new knowledge to the field of anesthesiology (5) (6), but rather it emphasizes the utility of caudal block anesthesia as a valuable adjunct to spinal block anesthesia and local infiltration in the armamentarium of the Naval surgeon.

INDICATIONS AND CONTRAINDICATIONS

Caudal anesthesia can be used to advantage in perineal procedures, anal and rectal operations, and in genito-urinary surgery. These areas in which such operations are performed are within the realm of the sacral and coccygeal innervation where the caudal approach has its greatest utility. The principal nerves are the pudendal, arising from S-2-3-4, with its branches, the perineal, internal hemorrhoidal, scrotal, and the continuation as dorsal nerve to penis. In addition, there is a pelvic splanchnic nerve from S-2-3-4, which joins the sympathetic plexus, and is then distributed to the urogenital organs and the lower part of the large intestine.

This method is contraindicated for patients with congenital or acquired gross deformities of the lower spine, particularly in the region of the sacrum; in local infections around the sacral hiatus, as in a teratomatous cyst, and for patients with a history of sensitivity to the analgesic agent.

TECHNIC FOR INDUCTION

The equipment required consists of the following: Luer syringe, 10 cc.; Luer syringe, 2 cc.; medicine glass; needles, No. 26 (hypodermic) and No. 20, 7 cm.; and 2-percent procaine, 30 cc., with 5 minims epinephrine, 1:1,000.

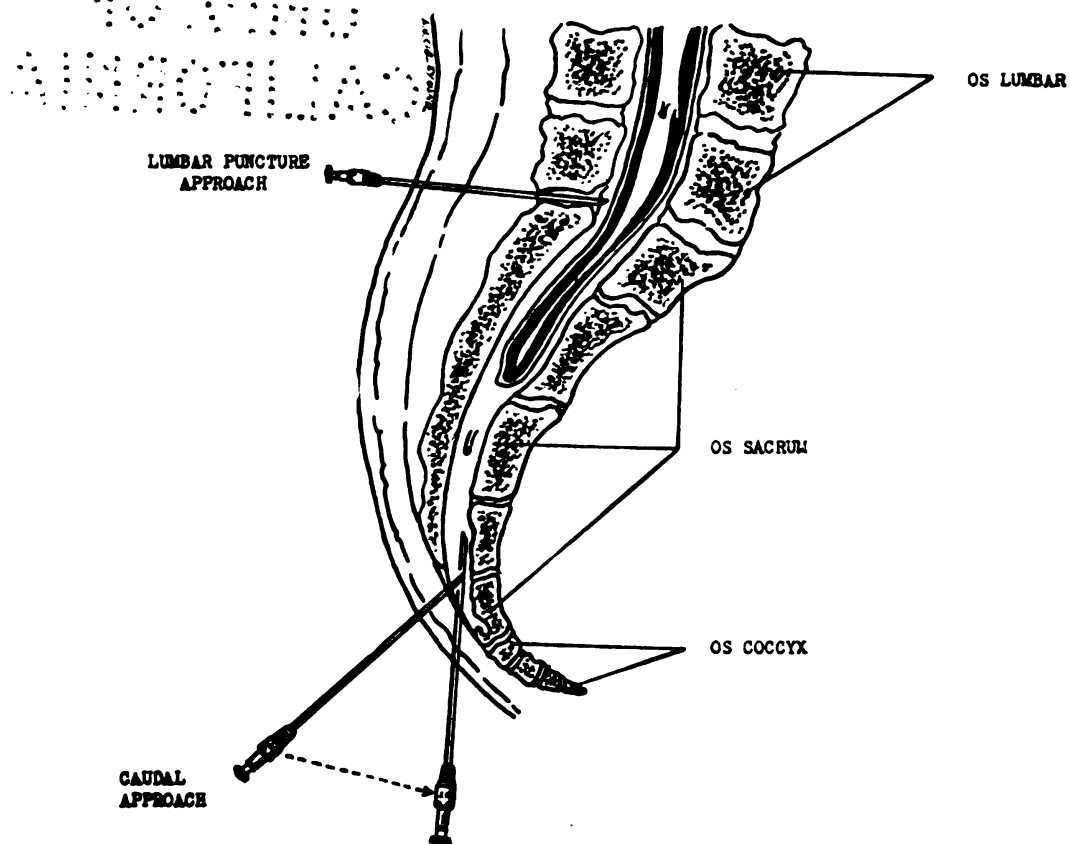
The Sims' position is preferred to the arched full prone position as described by most writers. The position is assumed easily and requires less moving of the patient on the operating table before and after induction. When only the standard field operating table is available, the Sims' position is more practical.

On palpating the sacral region, the separation between the coccyx and sacrum is easily located between the divergent sacrococcygeal ligaments. A procaine skin wheal is made directly over this depression, and the subcutaneous tissues are infiltrated with procaine down to the periosteum of the posterior coccyx. The needle (No. 20 gage, 7 cm. long) is introduced through this skin wheal until bony hardness is encountered. With the bevel facing the coccyx, the point of the needle is aimed about 90 degrees cephalad. The needle is continued in midline beneath the shelf of the sacrum while slight resistance is encountered which yields to gentle pressure. A common error is the failure to keep the needle directed in midline.

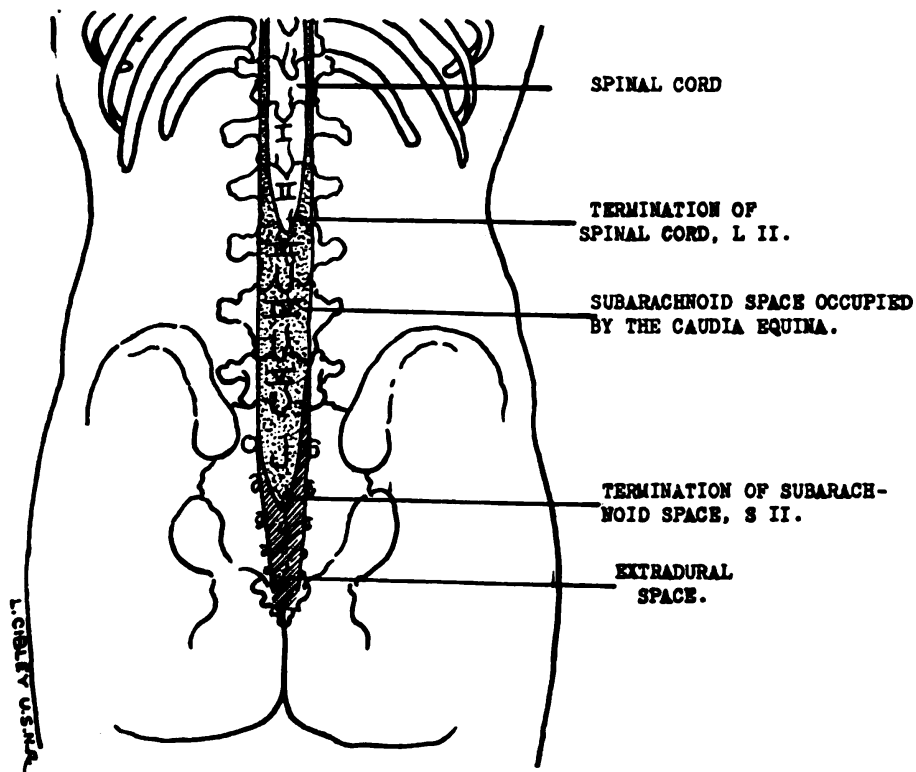
The needle is introduced to a distance of from 3 cm. to 4 cm., but it should never go beyond the second sacral foramina as the lower end of the dura may be entered. The stilet of the needle can be used for measuring the position of the needle point. If spinal fluid is obtained the case is considered unsuitable for caudal anesthesia. In this event, with the patient in the semiprone position, it is a simple maneuver to shift to the lumbar region to administer a low spinal anesthesia. The amount of 30 cc., 2-percent procaine, injected inadvertently into the subarachnoid space would endanger the patient. If blood is encountered the needle should be withdrawn slightly, and the syringe aspirated before injection of the anesthetic agent. The injection should be done slowly, because a sense of fullness, with "cramps" in the thighs, is experienced in a rapid injection. There is little resistance encountered in injecting the solution when the needle is properly placed. No anesthetic agent should be forcibly injected into the caudal space. If the needle has not entered the caudal space and the solution is injected into the soft tissues overlying the sacrum, a bulge will be seen in this region.

After injection the needle is withdrawn and the patient assumes a flat position on the table to assure equilateral distribution of the anesthesia. If 2-percent procaine is used the patient is ready for operation in from 10 to 15 minutes. Metycaine, 1.5 percent, is a faster-acting anesthetic agent, and, for this reason, is being preferred to procaine in obstetrics. The duration of analgesia for a single injection is from 45 minutes to an hour and a half. Epinephrine may be used with the procaine to prolong the effect of the anesthesia.

Fluids injected into the peridural space by the caudal approach can rise to varying levels of anesthesia depending upon the amount



1. Sagittal section through lower lumbar vertebrae, sacrum and coccyx, showing site of lumbar puncture and caudal injection.



2. Diagrammatic representation of relationship of spinal cord, reflection of dura and the extradural space.

of the preparation used and the speed with which it is forced into the canal. We have seen a sensory level of anesthesia up to D-6, with only partial loss of motor function in the lower extremities and with no fall in blood pressure. However the level of anesthesia can be readily limited to sacral distribution by adherence to the technic outlined.

COMMENT

The caudal approach for miscellaneous operations requiring a saddle-type distribution of regional anesthesia has been used at this activity in 65 unselected cases, 35 hemorrhoids, 7 fistulas in ano, 11 anal fissures, and 12 circumcisions. For lower urologic procedures, such as in cystoscopies, caudal anesthesia has been used almost exclusively.

This approach has resulted in satisfactory anesthesia with minimum effort and danger. It has been more satisfactory for our purpose in dispensary surgery than low spinal anesthesia, local infiltration, or local block of pudendal nerves. When equipment and trained personnel are limited, every effort should be made to keep procedures as simple and foolproof as possible.

Advantages.—In addition to the advantages of simplicity and relative safety, it has been found that the induction is attended by a negligible degree of discomfort. The sacrococcygeal region in the midline has a relatively high threshold of pain sensitivity, and the area traversed by the needle has no sensitive dura to puncture as in a spinal approach. Excellent relaxation of the anal sphincter is had, comparable to that found in spinal anesthesia.

As contrasted with spinal anesthesia there is no fall in blood pressure during an operation under the caudal method. Postoperative catheterization, nausea, vomiting, or headaches, such as occasionally hinder postoperative convalescence of the patient having spinal anesthesia, occur infrequently.

Under dispensary conditions local anesthesia in a group of unselected cases of anal operations is less satisfactory than caudal anesthesia. Local infiltration, or even the block of pudendal nerves, causes more painful "needling" than the caudal approach. There is less relaxation of the anal sphincter obtained than with the caudal method. The amount of anesthetic agent used in local anesthesia approaches the amount required for a caudal block.

Disadvantages.—Caudal anesthesia has certain obvious disadvantages. It is a slow-acting anesthesia, requiring from 10 to 15 minutes following the administration of 2-percent procaine before analgesia is obtained. The amount of anesthetic agent, 30 cc. of 2-percent procaine, although far below a dangerous amount in the average patient, is greater than in the spinal approach. An equivalent saddle-type distribution anesthesia is had with 50 mg. of procaine in 2 cc. of cerebro-

spinal fluid. One-percent procaine in quantities as low as 15 cc. has been used, but with less satisfactory results.

Each patient is given $1\frac{1}{2}$ grains nembutal, $\frac{1}{8}$ grain morphine, and 1/200 grain scopolamine. With this premedication the adopted routine use of 30 cc. of 2-percent procaine has resulted in no unfavorable sequelae.

REFERENCES

1. HINGSON, R. A., and SOUTHWORTH, J. L.: Continuous caudal anesthesia. *Am. J. Surg.* 58: 93-96, October 1942.
2. HINGSON, R. A., and EDWARDS, W. B.: Continuous caudal analgesia in obstetrics. *J. A. M. A.* 121: 225-229, January 23, 1943.
3. ADAMS, R. C.; LUNDY, J. S.; and SELDON, T. H.: Continuous caudal anesthesia or analgesia; consideration of technic, various uses and some possible dangers. *J. A. M. A.* 122: 152-158, May 15, 1943.
4. SOUTHWORTH, J. L.; EDWARDS, W. B.; and HINGSON, R. A.: Continuous caudal analgesia in surgery. *Ann. Surg.* 117: 321-326, March 1943.
5. BERRY, G. P.: Caudal epidural anesthesia in perineal surgery of genito-urinary tract; report of 165 consecutive cases. *J. A. M. A.* 90: 1018-1021, March 31, 1928.
6. REUTHER, T. F.: Caudal anesthesia in proctology. *Internat. Clin.* 3: 183-188, September 1938.



EFFECT OF WEATHER ON MAN

To the passage of alternating tropical and polar air masses, i. e., the cyclonic circulation, the normal human organism constantly adjusts in wide autonomic excursions involving all organs and tissues. The passage of a polar air mass is associated with a sympathicotonia whereby the organism seeks to insulate itself. The blood from the periphery is relatively more alkaline at this time; then smooth muscle tone is increased, blood pressures rise, and a relative anoxia obtains in large regions of the periphery. A corrective reversal of the disturbed organ-balance takes origin with the production of capillary-active substances in such regions of anoxia. As a result, the organism becomes more acid, blood pressure falls, the capillaries become more permeable, smooth muscle relaxes, the tissues become hydrated, etc. If coincidentally a tropical air mass passes, this phase of reversal may in time be accentuated, and tissue swelling, sharply falling blood pressure, etc., may reach stages that come to clinical consciousness, as, for instance, in the arthritic "weather prophet."

It must be obvious that with such organic pendulation (probably exaggerated in the allergic patient) one extreme state or the other will be reflected with an accentuation of unfavorable symptomatology, and the other will be associated with the opposite state.—PETERSEN, W. F., and VAUGHAN, W. T.: Weather and death in asthma. *J. Allergy* 15: 97-107, March 1944.

ANESTHESIA IN MILITARY MEDICINE

ADMINISTRATION BY THE UNSKILLED

MORTIMER B. GENAUER

Lieutenant Commander (MC) U. S. N. R.

In civil practice the need for a specialized anesthetist is regarded as axiomatic, and yet often at isolated Naval stations and on smaller vessels the anesthetic must be given by a medical officer whose only training in anesthesia may have been limited to medical school lectures on the subject, or to the occasional anesthetic he gave during an internship. Often a dental officer, likewise possibly inexperienced in anesthesia, is called on to administer the anesthetic. Men are being trained in anesthesia by the armed services, but until the need has been fully met, all medical officers should have a better understanding of the problems.

Preoperative medication.—The desired effects of satisfactory preoperative medication are decreased basal metabolism plus sedation and some degree of analgesia. Lowering the basal metabolic rate of a patient calls for a correspondingly smaller amount of the anesthetic. Sedation reduces the patient's preoperative mental apprehension, and minimizes the excitation produced by operating room noises. Analgesia is important in preventing the onset of shock resulting from pain. Nausea, retching, and vomiting occur less frequently with proper preoperative medication.

The amount of drug given depends on the age, sex, weight, vitality, degree of fever, metabolism, psychic state, and general health of the patient. Although children require smaller amounts of premedication than adults, they often require more than would be given on the basis of age alone. This is understandable because the metabolic rate of children between the ages of 8 and 12 years ranges between 46 and 48 calories per hour per square meter of body surface, and gradually decreases through adolescence. The doses for women are usually smaller than for men, although the emotional status of a woman may necessitate larger amounts. Debilitated persons require smaller doses, and when fever is present the dose is increased in proportion to the degree of temperature. Pathologic changes that are anticipated also determine dosage. Barbiturates are usually contraindicated in severe impairment of the liver. Opiates should be used cautiously in cases of increased intracranial pressure. Drugs em-

ployed may vary with the anesthetic agent chosen; for instance, atropine is often substituted for scopolamine when more irritating anesthetic agents are employed.

No attempt will be made to compare the effectiveness of related barbiturates, inasmuch as such information may be found in any standard textbook on pharmacology.

With spinal, regional, or field block anesthesia, unless diagnostic in nature, $\frac{1}{3}$ grain of pantopon with $\frac{1}{150}$ grain of scopolamine are given $1\frac{1}{2}$ hours before operation, followed in an hour by $1\frac{1}{2}$ grains of nembutal. For general anesthesia $\frac{1}{4}$ grain morphine replaces the pantopon. In 400 operations in which spinal anesthesia was administered, Sellman (1) showed the incidence of nausea, retching, and vomiting to be greater in a series of cases in which the upper part of the abdomen was involved than in a series of cases with lower abdominal involvement. In both series of cases, however, symptoms occurred less frequently with pantopon than with morphine. When intravenous anesthesia is used, nembutal is often omitted preoperatively.

Choice of anesthetic agents.—After sedatives have calmed a wounded and apprehensive patient, local anesthesia is probably the safest method to employ. When it is carefully used, it can be made to last a long time. Vasoconstricting drugs added to the anesthetic agent are helpful. Many minor and even major surgical procedures can be performed under local anesthesia with relative safety. Even though nerve blocks may not always be adequate, the amount of ether needed for supplementary anesthesia will be reduced.

Open-drop ether, in the presence of impending shock, is preferable to spinal anesthesia. Once spinal anesthesia has been established it cannot be controlled; whereas the use of ether permits the stage or plane of anesthesia to be lightened to a level consistent with the degree of shock present.

Boyle (2) is of the opinion that spinal block is the best method in shock associated with wounds of the lower extremities. Sise (3) emphasized the complications arising from the aspiration of stomach contents while under general anesthesia, particularly significant in combat zones when a man may be wounded immediately following a meal. Schuhmacher and Eversole (4) contend that hemorrhage and shock do not contraindicate spinal anesthesia, because the use of preoperative fluids, transfusions, and vasoconstrictor agents has reduced operative hazards. Beecher (5), on the other hand, warns against the unbridled use of spinal anesthesia in war injuries. He states that although vasoconstrictors are often adequate to prevent a serious fall in blood pressure, they are frequently inadequate to maintain safe blood pressure levels. He stresses that in spinal anesthesia, the vaso-

constrictor fibers are the first to be paralyzed and are the last to recover; thus, an important defense mechanism against shock is lost. He quotes a recent comment by Gordon-Taylor (6); "Spinal anesthesia spells certain euthanasia for the shocked abdomen."

This article is in agreement with Beecher regarding the relative merits of ether over spinal anesthesia in cases of impending shock. Beecher's opinions are based on clinical observations rather than on scientific data. Ether given to patients with ruptured spleens, traumatic amputations, severe compound fractures, gunshot wounds of the abdomen, ruptured peptic ulcers, and ectopic pregnancies produced conditions less troublesome to the surgeon and to the anesthetist than if spinal anesthesia had been given. With greater knowledge of ether administration the disadvantages attributed to its use may be overcome. Until more scientific data are submitted by anesthetists engaged in military duty, the ability of the attendant to give one anesthetic more skillfully than another remains an important factor in the surgeon's choice of an anesthetic agent.

Some general anesthetic agents are relatively unsafe in the hands of the untrained anesthetist. Chloroform has value in being noninflammable, but its profound depressing effects on the circulatory system, causing a fall in cardiac output, decreased blood pressure, and slow pulse rate, make its use dangerous. Ethyl chloride is not only explosive but is also a marked respiratory depressant. Chloroform and ethyl chloride, however, may be used for induction when they are carefully administered with an adequate supply of oxygen. The commercial variety of oxygen available on all Navy ships is satisfactory. When either chloroform or ethyl chloride is employed, anesthesia is not carried to the stage of muscular relaxation before the shift to ether is made, but only to the stage at which the slow addition of ether has lost its irritating effects.

Technic for spinal anesthesia.—The following technic for spinal anesthesia is recommended:

1. Ephedrine in doses ranging from 25 mg. to 50 mg. is mixed with the novocain which is used to raise the intradermal wheal. This procedure minimizes the initial fall in blood pressure, which so often follows the injection of an anesthetic agent into the spinal canal. For the usual operations 1 mg. of crystalline procaine per pound of body weight is adequate.

2. For longer anesthesia the combination of pontocaine and dextrose gives satisfactory results. Amounts ranging from 15 mg. to 18 mg. of pontocaine in a 1-percent solution are diluted with $1\frac{1}{2}$ times the volume of 10-percent dextrose, and then injected.

3. The patient is placed in a 10-degree Trendelenburg position long enough to allow the anesthesia to reach the proper height, after which

he is returned to a level position, and a pillow is placed under his head.

Contraindications and indications in intravenous anesthesia.—Intravenous anesthesia in the unconscious patient is contraindicated. It has been used to advantage in war surgery when profound shock was not imminent. Beecher, McCarrell, and Evans (7), experimenting on animals, showed that on the basis of available evidence, the barbiturates appear to delay shock by comparison with ether, when the chief shocking trauma is dehydration or loss of plasma from wound surfaces. Betcher (8) states that no contraindications to the use of pentothal sodium have been observed for patients receiving sulfa drugs. It has been found satisfactory for such procedures as the reduction of dislocations and splinting of simple fractures, the treatment of burns, changes of painful dressings, minor amputations, removal of shell fragments, excisions of carbuncles, debridement, removal of teeth, and the ligation of bleeding vessels. Also, when spinal anesthesia has begun to wear off, pentothal sodium has been used to allow completion of an operation. Its choice as an anesthetic agent on board ship and at small stations is due to the rapidity and lightness of anesthesia, the noninflammability, and the simple equipment needed in its administration.

The cardinal points in the administration of intravenous anesthesia are (9):

1. The use of a 2.5-percent solution of pentothal rather than a 5-percent solution is recommended, as well as its slow injection, permitting a better evaluation of the depth of anesthesia.
2. The maintenance of a clear airway, and preparation for artificial respiration and administration of oxygen are important.
3. Usually from 10 cc. to 12 cc. of a 2.5-percent solution are required to induce sleep, and an additional 4 cc. or 5 cc. suffice for surgical manipulation.
4. These amounts are arbitrary, however, and close observation of the patient for relaxation, depth of respiration, and color is necessary for safety in administration.

Accidents associated with anesthesia.—Accidents attributed to the administration of anesthesia may be grouped as circulatory, respiratory, and miscellaneous, this including explosions, ether burns, and eye injuries.

Circulatory variations in blood pressure and direct cardiac involvement are most frequent. The blood pressure may either rise or fall. Blood pressure elevations are caused by a slight increase in the carbon dioxide content of the blood, or by a secretion of adrenin during the excitement stage of induction. A fall in blood pressure is caused by hemorrhage or by vasodilatation.

Sufficient oxygen, a clear airway, and proper premedication will minimize dangers of blood pressure elevation. Fluids, transfusions, plasma, and vasoconstrictors, such as ephedrine and pitressin administered subcutaneously, will usually offset accidents produced by a fall in blood pressure. Careful administration of chloroform will help to prevent ventricular fibrillation. With immediate diagnosis, treatment of cardiac arrest consists of artificial respiration under oxygen, and stimulation of cardiac activity by direct massage. Unless the ventricular fibrillation is fleeting in character, death is inevitable.

Deaths arising from respiratory complications attributed to anesthetic agents may result from overdosage by an unskilled anesthetist, death occurring in the fourth stage of anesthesia. Fortunately, open-drop ether must be resorted to in the field or on small craft, so that the likelihood of death from improper mixtures of gases is minimized. Overdoses of morphine and other drugs may bring about depressed respiration and eventual death. Deaths caused by intercostal or diaphragmatic paralysis may occur under spinal anesthesia.

Respiratory deaths, not due directly to the anesthetic agent itself, usually are caused by obstruction. Obstruction is the most frequent cause of respiratory difficulty. It may occur anywhere along the respiratory tract, and includes such difficulties as relaxation of the jaw, with resultant "swallowing" of the tongue, and laryngeal and bronchial spasm. Mechanical obstructions are caused by excessive secretions and aspiration of stomach contents or foreign objects. Preoperative examination of the mouth for loose or foreign bodies is important.

The use of an oral airway, and turning the patient's head to a side will help keep the upper airway patent. In "swallowing" of the tongue, support of the lower jaw at its angles is usually adequate to maintain a free airway. Often the accumulation of carbon dioxide stimulates the respiratory center to force oxygen past the spastic type of obstruction. The anesthetic under these circumstances must be discontinued temporarily.

When general anesthesia is to be employed following the ingestion of food, it may be best to aspirate the stomach contents preoperatively. If this is not feasible, a light anesthetic may be given, the patient being allowed to vomit during induction. The oral cavity is cleaned, and a satisfactory anesthesia may then be given safely. The patient may be placed in the Trendelenburg position if further vomiting is expected.

Another method may be such rapid induction that the patient passes the second stage of anesthesia without occurrence of the vomiting reflex. In that case, special care should be taken postoperatively during recovery from anesthesia, because vomiting may occur at this time.

Miscellaneous accidents.—Other accidents include conjunctivitis and ether burns of the skin. These may be minimized by ophthalmic ointments and by coverings of the face and eyes.

SUMMARY

An attempt has been made to evaluate the more common anesthetic problems encountered by physicians under military conditions. Pre-operative medication and various anesthetic agents most likely to be used in stations far removed from proper anesthetic equipment were discussed. Various accidents, with their prevention and treatment, were presented to guide the unskilled anesthetist in meeting some of the more common difficulties. The need for adequately trained anesthetists and for further scientific data in the choice of anesthetic agents under battle conditions was stressed.

REFERENCES

1. SELLMAN, P.: Symposium on spinal anesthesia: preoperative medication. *S. Clin. North America* 20: 621-629, June 1940.
2. BOYLE, A. K.: Value of low spinal block (lumbo-sacral) analgesia in treatment of shock associated with wounds of lower extremities. *J. Roy. Army M. Corps* 76: 339-340, June 1941.
3. SISE, L. F.: Anesthesia for emergencies. *Am. J. Surg.* 46: 413-416, December 1939.
4. SCHUHMACHER, L. F., JR., and EVERSOLE, U. H.: Technics of spinal anesthesia. *Anesthesiology* 3: 630-643, November 1942.
5. BEECHER, H. K.: Choice of anesthesia for seriously wounded patients. *J. A. M. A.* 121: 899-903, March 20, 1943.
6. GORDON-TAYLOR, GORDON: Cited in reference 5.
7. BEECHER, H. K.; MCCARRELL, J. D.; and EVANS, E. I.: Study of "shock-delaying" action of barbiturates; with consideration of failure of oxygen-rich atmosphere to delay onset of experimental shock during anesthesia. *Ann. Surg.* 116: 658-667, November 1942.
8. BETCHER, A. M.: Pentothal sodium; survey of its field of usefulness in a military hospital. *War Med.* 4: 425-432, October 1943.
9. EDWARDS, S., and HAND, L. V.: Intravenous anesthesia (pentothal). *S. Clin. North America* 22: 925-931, June 1942.



BONNET TEST

With the patient in the supine position, the thigh and knee are acutely flexed on the abdomen and the thigh is then adducted, thus putting the capsule of the sacro-iliac joint on the stretch, and if pain is present in the sacro-iliac region the test is positive. This test was developed as a test for sacro-iliac joint disease, but a positive Bonnet test is also frequently present in herniated disc lesions.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

PROCAINE HYDROCHLORIDE 4-PERCENT

INDICATIONS FOR USE

JOHN C. FARQUHAR

Lieutenant Commander (DC) U. S. N.

There are many occasions in the routine practice of dentistry which necessitate the use of local anesthetics of higher concentration than are generally employed by the profession. The use of 2-percent procaine hydrochloride is accepted as the appropriate strength for dental anesthesia, and is adequate for most dental operations; however, in root canal therapy, in the preparation of cavities when the dentine is hypersensitive, and in the removal of third molars whose roots approximate the mandibular nerve, 2-percent solutions of procaine frequently fail to produce adequate anesthesia. In such cases dentists sometimes are inclined to think that the injection technic was faulty rather than the anesthetic agent used. Failure, however, is often due to inadequate strength of the solution, so that it cannot penetrate the nerve fibers to a sufficient depth to produce profound anesthesia. When there has been failure of anesthesia with 2-percent procaine, it is frequently the case that reinjection with the same strength of solution will again result in failure, because the concentration is not sufficient to produce the depth of anesthesia desired. This is true particularly when the larger nerve trunks, such as the mandibular, are involved. "The concentration necessary is in direct proportion to the size of the nerve involved" (1).

SAFETY AND STRENGTH OF SOLUTION

There is some doubt as to the safety of using 4-percent solutions of procaine. There is fear that severe reaction might result from its use. The few reports of true procaine reaction indicate the rarity of such a condition. Most investigators agree that what is commonly called a "novocain reaction" is usually a reaction to the vasoconstrictor employed, and not to the procaine itself. It is not likely that any one operator will encounter many persons with extreme susceptibility to procaine poisoning (2). The dental section of the Mayo Clinic has been using 4-percent solutions in indicated cases for a period of 10 years with no untoward results (3).

Although procaine is a poison in excessive amounts, the quantity required for any dental surgery is far below a toxic dose, so that the

operator need scarcely consider quantity of the drug as a major danger in other than exceptional cases. General surgeons have for years used as much as 250 cc. of 0.5-percent solutions with no secondary effects except occasional vomiting. According to Braun (4), 1.25 gm. (20 grains) of novocain may be injected without fear of intoxication; that is, 250 cc. (8 ounces) of a 0.5-percent solution, or 125 cc. of a 1-percent solution, or approximately 31 cc. of a 4-percent solution may be used.

SYMPTOMS OF PROCAINE REACTION

Should a procaine reaction be encountered, one might expect the following signs to be present: Slow pulse, fall in blood pressure, pallor, apprehension, tremor, and dyspnea. A more violent reaction may result in collapse, cyanosis, and death. A reaction to the vasoconstrictor alone would result in an increase in pulse rate, respiration, and systolic blood pressure. The latter signs are of short duration, frequently only a matter of minutes, when the concentration of the vasoconstrictor is above 1:30,000; thus it is that when procaine and epinephrine are used together, a reaction to the epinephrine alone will produce an increase in respiration, pulse rate, and systolic blood pressure. In the same combination when there is reaction to the procaine content there likewise will be an increase in the pulse rate but a decrease in blood pressure (5) (6).

Differential diagnostic test.—It is obvious that these symptoms might be confusing to the anesthetist, making differential diagnosis difficult. If it were desired to ascertain whether there was a true sensitivity to procaine present, a wheal of isotonic saline solution could be raised to eliminate the psychic factor, and then a small amount of procaine solution, minus a vasoconstrictor, injected, and the results observed. If there was no reaction to either the saline or the anesthetic agent, it would indicate that the causal agent was the vasoconstrictor. When this is the case, premedication with pentobarbital sodium, and placing the patient in a horizontal position while injecting will usually prevent disagreeable reactions. Reduction of the concentration of the vasoconstrictor to 1:120,000 may be indicated in cases of poor risk; however, should the test prove that sensitivity to procaine does exist, one of the other local anesthetics should be employed.

Allergies.—Although procaine allergies seem to be unusual, one will find those who are sensitive to it just as one will find those sensitive to ragweed or cat's hair. If procaine sensitivity does exist, reaction will occur from 2-percent solutions as well as 4-percent solutions. Contact allergy to procaine is seen occasionally, and it is interesting that Lundy (5) and others (6) have injected procaine in such cases without any untoward results. It is maintained, therefore, that

the possibility of reaction does not preclude the use of stronger solutions of this anesthetic agent.

Local tissue reaction.—There is no evidence to contraindicate the use of 4-percent procaine from the standpoint of local tissue reaction. Farr (7) states that as high as a 10-percent solution may be injected without causing any irritation. There is no afterpain or tendency toward the production of tissue necrosis. Powdered novocain can be sprinkled upon fresh wounds in delicate structures, such as the cornea, without irritation (8). Tainter and Moose (9) show that a 4-percent procaine hydrochloride solution is virtually isotonic.

CONCLUSIONS

The trend toward other and newer local anesthetic agents is the result of the failure of 2-percent solutions of procaine to produce adequate anesthesia in many cases. Procaine is still the least toxic of all anesthetic agents, and in 4-percent strength attains the efficiency sought after in others.

The same quantity of this stronger solution may be used with the same rate of injection as is advised in the literature for a 2-percent solution. Although the 4-percent solution is of greater strength, there must be sufficient quantity present to encompass the area to be anesthetized. The added strength does not necessitate slower injection.

Procaine hydrochloride in 4-percent strength is a safe, practical local anesthetic agent. If employed when indicated, it will perform well.

REFERENCES

1. STAFNE, E. C.: Dental diagnosis, anesthesia, and extraction. Read before the Texas State Dental Society, San Antonio, April 26-30, 1942.
2. WATERS, R. M.: Procaine toxicity; prophylaxis and treatment. *J. Am. Dent. A.* 20: 2211-2215, December 1933.
3. STAFNE, E. C.: Extractions in a general dental practice. *Canad. D. J.* 9: 491-502, November 1943.
4. BRAUN, H., and HARRIS, M. L.: *Local Anesthesia; its Scientific Basis and Practical Use.* Lea & Febiger, Philadelphia, 1924. pp. 116-122.
5. LUNDY, J. S.: *Clinical Anesthesia.* W. B. Saunders Company, Philadelphia, 1942. p. 29.
6. PICKERING, P. P.; MCCOOEY, C. J.; STEINMEYER, H. P.; and LUCKHARDT, A. B.: Possible cardiovascular changes in local anesthesia. *J. Am. Dent. A.* 26: 1823-1828, November 1939.
7. FARR, R. E.: *Practical Local Anesthesia and its Surgical Technic.* Lea & Febiger, Philadelphia, 1923. p. 45.
8. BRAUN, H., and SHIELDS, P.: *Local Anesthesia; its Scientific Basis and Practical Use.* Lea & Febiger, Philadelphia, 1914. p. 122.
9. TAINTER, M. L., and MOOSE, S. M.: *Local anesthesia.* In Gordon, S. M.: *Dental Science and Dental Art.* Lea & Febiger, Philadelphia, 1938. Chapter 20.

ANALYSIS OF LOW INCIDENCE OF INFECTIOUS DISEASES AT A SECONDARY TRAINING CENTER

WILLIAM V. LULOW

Lieutenant (MC) U. S. N. R.

and

H. B. BENJAMIN

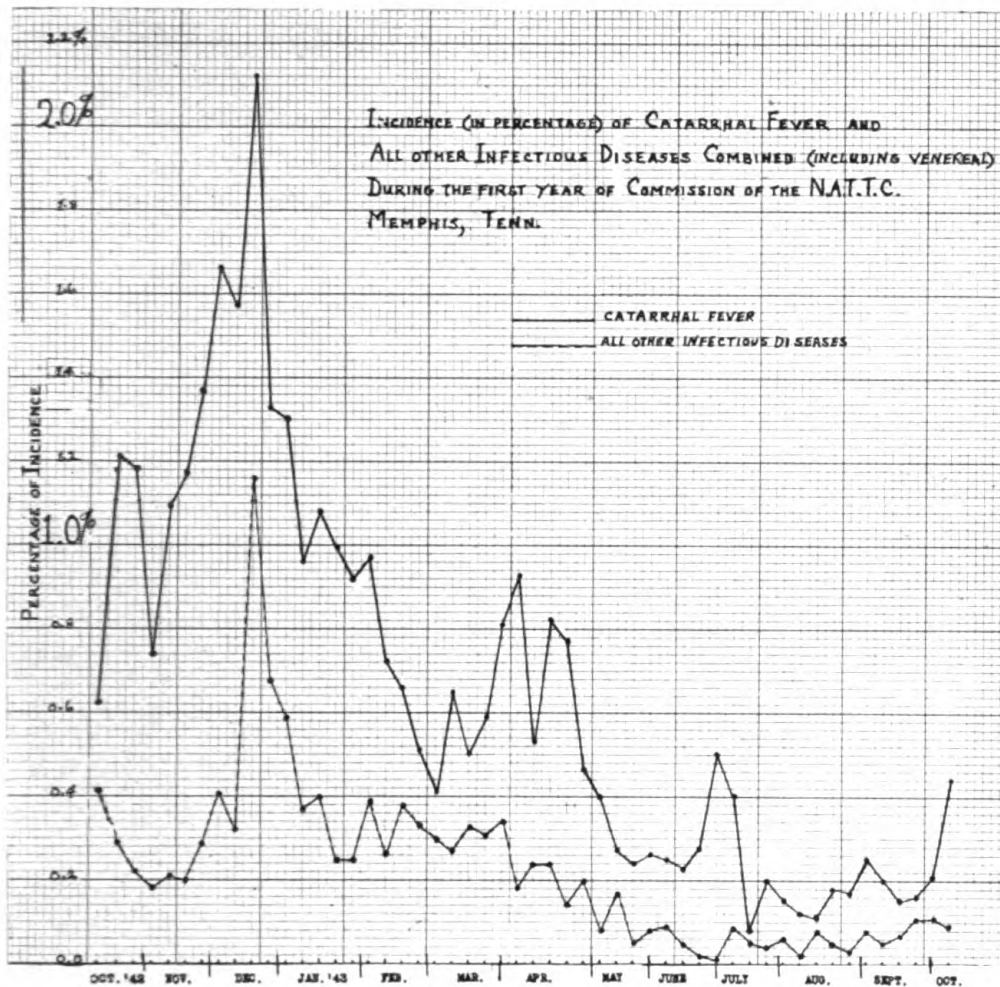
Lieutenant Commander (MC) U. S. N. R.

During the first year of commission of this Naval Aviation Technical Training Center a remarkably low incidence of infectious diseases was noted. It is significant that the greatest weekly incidence of infectious diseases, including the venereal diseases but excluding catarrhal fever, was 1.08 percent. Also noteworthy is that during the entire year, with the exception of the 4-week period from 13 December 1942, to 10 January 1943, the weekly incidence did not rise above 0.4 percent. The incidence of catarrhal fever, which includes practically all the upper respiratory diseases, is proportionately low (graph 1).

At this activity where large numbers of men from all parts of the country are congregated, eating, sleeping, and attending school together, the high morbidity rate encountered in some heavily populated military areas is not seen. Several factors appear to have a direct bearing upon this unusual health record. The first of these, "previous herding," is epidemiologic in nature. Nearly all the men arrive from the various Naval training schools. Prior to their arrival at this station, they have lived together in large numbers for a period of not less than 6 weeks. It is during this time that the exchange of upper respiratory infections occurs. The "new susceptibles in the herd" acquire infection and develop immunity.

The sporadic cases of scarlet fever, measles, and the like that occur are usually seen in men newly arrived. Often the clinical symptoms are evident on arrival, indicating that the contact had been made enroute or even prior to entraining.

This period of "acclimatization" accounts for the relatively high incidence of infectious diseases as well as some epidemics in the recruit training at boot camp. Those who are not immune either acquire immunity or become ill. One could speculate therefore that the incidence of acute infectious diseases would be low at a secondary training center. As most of the infectious diseases result in varying



Graph 1.

degrees of immunity, we do not expect to encounter large outbreaks following the first 6-week period of close association. It is within this first period of "herding" that trained epidemiologists should be utilized to the fullest extent. Direct and complete control of the command at this time is essential.

The average age of the students is 19.8 years, which in itself makes for rapid powers of recuperation and development of immunity. This factor, together with the period of contact with upper respiratory organisms at training camps, results in large groups of men immune to the common contagious diseases.

Two factors at this training center, the restriction placed upon liberty and the vigorous athletic program, also influence the incidence of infection.

Liberty is granted once in 8 days for a period of 9 hours, from 1700 to 0200, and one week-end each month, from 1700 Saturday to 2200 Sunday. This allowance includes about 2 hours' traveling time. The

students can therefore spend but little time in the city. This precludes the lowering of their resistance via the time-honored methods of alcoholic indulgence and lack of sleep. Because of this inadvertent hoarding of their powers of combating disease, the incidence of infection among this group is greatly reduced.

The athletic program also helps in increasing and building up the resistance acquired in boot camp. The athletic program is designed to develop courage, stamina, agility, and general well-being, which must necessarily aid in the resistance to disease. Athletic training and contests are held out of doors as much as possible throughout the entire year. Four weeks of swimming, stressing endurance, keeping afloat, abandoning-ship drills and lifesaving, 2 weeks each of track, wrestling, hand to hand combat, soccer, and boxing, constitute the athletic program. There is also a strenuous commando course covering a 2-week period. For 15 minutes every day calisthenic drill is conducted outdoors. Such a rugged program of body building must show its effects upon the physical condition of the participants. It insures good appetites and good sleeping habits and keeps the mind and body occupied.

From an epidemiologic standpoint it is important to observe the living quarters of the men. The average floor space in the barracks is 23 square feet and 249 cubic feet per man. The men sleep in 2- or 3-decker bunks placed 3 feet apart. As far as other sanitary facilities are concerned, the ratios at this station are well within the limits prescribed in the Manual of the Medical Department. There are 8.4 men per head, 4.9 men per washbowl, 10.3 men per shower, and 14.6 men per urinal. Ventilation is adequately provided by numerous windows on both sides of the bulkheads. Heating during the cold weather is adequate, but overheating at night must be carefully controlled. During the day the heat is turned off and the quarters are well aired. The cellars under the barracks are kept free of water.

In addition to the generalizations mentioned in the foregoing paragraphs, the introduction of an epidemiology unit in April 1943, offers a potent weapon in the fight against communicable diseases. A brief description of this unit's activity is included.

A strict watch is kept for early signs of diseases. Isolation, quarantine, and personnel inspection are instituted promptly when necessary. Food and food-handlers are constantly inspected, water and milk supplies constantly supervised. Sewage, garbage, and refuse disposal are investigated and controlled. Insect breeding is kept at a minimum. Bacteriologic studies reveal the focal points of any possible infectious outbreaks and provide the avenues for diagnosis and control of such occurrences.

The importance of this generalized program of preventive measures cannot be overemphasized. The epidemiologic factors peculiar to the massing together of enormous groups of men, the problem of housing, feeding, sick-care, and sanitation require much study and hard work but the rewards of strict control are readily apparent.

SUMMARY

1. An attempt has been made to discover the causes of the low incidence of infectious diseases during one year at a secondary training center.

2. "Previous herding" at recruit camp is a probable factor in the acquisition of immunity.

3. The average age argues for excellent powers of resistance and recuperation.

4. The restrictions upon liberty exert an obvious beneficial influence.

5. A well-rounded athletic program appears to be invaluable.

6. Proper living quarters, in particular, more than ample washing facilities, are considered to be most essential.

7. The general, over-all supervision by the epidemiologist of all factors pertaining to the actual control, as well as prevention of outbreaks of infectious diseases, is perhaps the single most important factor in maintaining low morbidity rates.



SULFAPYRAZINE

One of the most promising of the new antibacterial sulfonamide agents is sulfapyrazine, recently released under the Food and Drug Act for general use. It has been developed as a result of researches conducted in the last year or so. The value of sulfapyrazine lies in its apparent quality of therapeutic value similar to sulfadiazine, against beta-hemolytic streptococci and pneumococci. Coupled with smaller dosage to obtain effective blood levels and lesser toxicity, it has an additional possibility in that it may be equally or more effective than sulfaguanidine and succinylsulfathiazole in bacillary dysentery. Chemically, this product is an isomer of sulfadiazine, where its superior qualities may be traced to a mere rearrangement of the nitrogens in the pyrimidine ring.—HOLLAND, M. O.: New developments in pharmaceutical practice. *Am. J. Pharm.* 116: 102-119, March 1944.



MEASUREMENT OF CIRCULATION TIME

Measurement of the circulation time offers a simple means of recognizing and indexing a differential diagnosis of cardiac damage. The velocity of the blood-flow depends on the cardiac output, provided the volume of circulating blood remains the same; the cardiac output is inversely proportional to the circulation time. The test, of course, cannot provide the sole basis for a diagnosis any more than radiology and electrocardiography can; but with the clinical and other findings the circulation time is a help, and is easy to do in the home.

The arm-to-tongue circulation time is measured with a solution of saccharin injected into a cubital vein and the patient is told that he will experience a sweet taste which he should announce immediately. To allow for circulatory readjustment after the use of the tourniquet and the venipuncture one should wait at least a minute after inserting the needle before injecting the solution, but then it should be injected as quickly as possible. The time is measured between the injection and the moment when the patient announces the sweet taste (which travels from the root of the tongue to the tip and vanishes quickly). The period can be checked by an ordinary watch, but a stop-watch is better. The normal circulation time as measured by this method is between 9 and 16 seconds. There are no untoward reactions, and the patient finds the sweet taste pleasant.—DURAS, F. P.: Measurement of circulation time with saccharin. *Lancet* 1: 303-304, March 4, 1944.



CONTINUOUS CAUDAL ANESTHESIA

After reviewing the accumulated findings of capable observers from many leading clinics, the principal forthcoming deduction is that although continuous caudal anesthesia as advocated by Hingson and Edwards is excellent to the degree of captivation in its analgesic achievement throughout both labor and delivery, it is a method fraught with too many highly dangerous complications to be acceptable except in specially selected cases conducted by specially trained anesthetist-obstetricians.

The degree of risk is such that the method's safety should not be stressed. Fortunately, the relief of childbirth pains does not require so major a procedure. Other efficient methods are simpler and safer.—McCORMICK, C. O.; HUBER, C. P.; SPAHR, J. F.; and GILLESPIE, C. F.: Experience with one hundred cases of continuous caudal analgesia. *Am. J. Obst. & Gynec.* 47: 297-311, March 1944.

CLINICAL NOTES

MEDIASTINAL EMPHYSEMA

REPORT OF TWO CASES

JAMES T. COWART

Lieutenant Commander (MC) U. S. N. R.

Traumatic emphysema of the mediastinum will become fairly common in military personnel as the war progresses. The two cases to be reported emphasize this fact.

Since the days of Laennec, attention has been directed to peculiar physical findings heard precordially—signs occurring spontaneously and with trauma—but not until 1934, when Hamman¹ reported four cases of spontaneous emphysema of the mediastinum, did a pathologic explanation of the crackling, crunching, popping sounds over the precordium become established.

The bizarre impressions received have led to their description as crunching, crackling and popping sounds. To this I add mine, that of the sticky, popping sound of noisily chewed gum.

Pathologically the disease is primarily an interstitial emphysema of the lung due to rupturing of alveoli, air escaping into the interstitial tissues. The air finds its way to the hilum along the course of the blood vessels and fascial planes into the mediastinum, becoming a mediastinal emphysema.

It is the air in the mediastinum, adjacent to the pericardial sac, that produces the physical signs heard over the precordium along the left sternal border. Because the physical signs are on the left does not necessarily imply that the site of the primary interstitial lung emphysema is on the left. As pointed out by Macklin² it is only when an area of atelectasis can be demonstrated by x-ray that there can be assurance as to the lung from which the air has escaped.

The outstanding symptoms and physical findings are: (1) Intense pain along the left sternal border near the tip; (2) dyspnea; (3) dis-

¹ HAMMAN, L.: Spontaneous mediastinal emphysema (Henry Sewall lecture). Bull. Johns Hopkins Hosp. 64: 1-21, January 1939.

² MACKLIN, C. C.: Pneumothorax with massive collapse from experimental local over-inflation of lung substance. Canad. M. A. J. 36: 414-420, April 1937.

tant heart sounds; (4) hyperresonance over the precordium. Some of these findings may give the impression of an apparent cardiac displacement to the right.

Both of my cases were studied carefully for cardiac pathologic changes. The following slight changes observed in the electrocardiogram of case 1 are worth noting: Lead IV initial negative deflection; T_4 wave diphasic and cove plane tendency. These findings were not seen in case 2 but as other cases are studied by electrocardiogram they may become more significant.

In case 1, air in the mediastinum was demonstrated. There was also a questionable air bleb about 1 cm. in diameter with a flattened base, which lay in the diaphragmatico-vertebral angle on the left, overlying the heart shadow. It may have been mediastinal, but could not be demonstrated on lateral films and was absent on anteroposterior films taken after symptoms subsided.

Differential diagnoses include: (1) Pneumothorax; (2) hemopericardium; (3) pneumopericardium; (4) cardiac contusion; (5) coronary occlusion.

CASE REPORTS

Case 1.—An ensign who bailed out of his airplane following a midair collision was admitted to the hospital complaining of severe substernal pain and difficulty in breathing. Physical examination revealed superficial abrasions of both shoulders, thighs and hips (chute burns). There was no external evidence of chest injury and no subcutaneous emphysema of the neck. Along the left sternal border, third to fifth interspaces, a sticky, popping sound was heard with each systole. The heart sounds appeared distant. Breath sounds over the left chest were diminished. The blood pressure was 100/60, pulse good and regular.

The pain continued during the night necessitating morphine, and the same sticky, popping sounds were heard along the left of the sternum on the following day. Blood pressure was 120/70.

X-ray examination revealed a calcified tubercle in the right base, clear lung fields, a very faint irregular broken line of rarefaction inside the right upper heart border and a $1\frac{1}{2}$ by $\frac{1}{2}$ cm. rarefied crescentic area above the left diaphragm near the spine.

The electrocardiographic report showed nothing remarkable except changes in lead IV possibly indicative of myocardial alteration. Subsequent electrocardiograms remained unaltered and were later interpreted as showing changes consistent with normal findings in this patient.

The patient was discharged to duty as cured approximately 6 weeks after the injury.

Case 2.—A Marine Corps private was struck in the left chest by another player while playing football (blocking). He was able to resume play for several minutes before experiencing intense pain in the left chest. On admission to the hospital he was complaining of excruciating substernal pain and dyspnea.

There was no external evidence of chest injury and no subcutaneous emphysema of the neck. Along the left border of the sternum from the third to the fifth interspaces there was a loud sticky, popping sound with each systole, and hyperresonance over the precordium. The breath sounds on the left and the

heart sounds were distant and regular. The blood pressure was 120/72. The patient was practically free of pain in a few hours, dyspnea rapidly disappearing. His general condition was good. The electrocardiographic examination was negative.

The x-ray findings were consistent with a protective muscle spasm on the left, producing moderately elevated diaphragm and protective scoliosis. There was buckling of the left lower ribs in the midaxillary line and a questionable incomplete fracture of the left seventh rib. Subsequent x-rays confirmed the rib fracture of a greenstick type without displacement.

Fluoroscopy and right oblique film of the chest disclosed soft tissue shadows in the posterior cardiophrenic angle in a right oblique view more prominent than normal and an increase of pericardial fluid.

The symptoms and signs gradually returned to normal and the patient was discharged to duty 12 days following injury.

COMMENT

The variations of the precordial sounds with change in position are worthy of note. In both cases the physical signs could be heard at times very clearly in a supine position. At other times it was necessary to have the patient rise upon his elbows, and arch his back to bring out these findings. There were occasions when the signs entirely disappeared, but could be heard distinctly later. If this condition is suspected, and no abnormal precordial sounds are heard in the supine position, it is well to remember that frequent examinations and often in many positions will be necessary to elicit this phenomenon.



SUB FASCIA LATA INFUSIONS

Administration of parenteral fluids beneath the fascia lata in 261 consecutive infusions of 1,000 c. c. of saline or 5 per cent dextrose showed that the average time for delivery of the solution was fifty-six minutes. In thirty-three patients the average time for absorption of the same amount of fluid by hypodermoclysis was 167 minutes.

Comparative studies were made on the rate of absorption between intravenous and sub fascial infusions.

Infusion can be estimated by comparing the phenolsulfonphthalein excretion with that of an intravenous infusion which may be considered to have immediate absorption.

On comparing the rate of excretion of the dye, it was found that there was only a difference of excretion in the two types of infusions of about one hour. Since the sub fascial infusions were adjusted to deliver the solution to the patient in just one hour, which was the same time taken for delivery of the intravenous fluid, it was concluded that there must be almost immediate absorption of the fluid.—

FINLEY, R. K.; SHAFFER, J. M.; and ALTENBERG, A.: Parenteral fluid administration beneath fascia lata. *Am. J. Surg.* 63:337-343, March 1944.

COCCIDIOIDOMYCOSIS

REPORT OF UNSUCCESSFUL TREATMENT WITH PENICILLIN

PAUL MICHAEL

Commander (MC) U. S. N. R.

RICHARD F. McLAUGHLIN

Lieutenant Commander (MC) U. S. N. R.

and

PHILLIP L. CENAC

Lieutenant, junior grade (MC) U. S. N.

Tager¹ of Yale University has performed in vitro experiments which showed that *Coccidioides immitis* was not materially affected by penicillin, and scattered reports of its use in human coccidioidomycosis have appeared in the literature. The following case is reported because it is believed to be among the first in which larger amounts of the drug have been used in cases of coccidioidomycosis and also because it demonstrates that there may be a long latent period following the primary infection in which there is apparent freedom from the effects of the disease.

CASE REPORT

A chief motor machinist's mate, 47 years old, reenlisted in the Navy in November 1942. At that time he was considered to be in good health and there were no clinical signs of any active disease. He was first admitted to the sick list in March 1943 while on duty at the Naval Air Station, Palmyra Island. At that time he had a fluctuating temperature and was complaining of weakness, anorexia, and headache. Because of progressive weight loss and increasing severity of symptoms he was transferred to the U. S. Naval Hospital, Pearl Harbor, T. H.

On admission to the hospital the patient was obviously ill and responded slowly to questioning. A few scattered petechial-like lesions which receded on pressure were noted on the palm and fingers of the right hand and the sole and toes of the right foot. A slight stiffness of the neck was noted but there were no abnormal reflexes. Lumbar puncture showed the spinal fluid to be xanthochromatic and under increased pressure. The cell count was 45, sugar 48 mg. percent, chloride 668 mg. percent, and protein 120 mg. percent. No growth appeared on culture of the fluid. The blood showed a moderate leukocytosis of 13,600 cells, with 69 percent segmented cells, 13 percent lymphocytes, 12 percent eosinophils and 6 percent monocytes. The blood sedimentation rate was 25 mm. in 1 hour.

Sulfonamides were administered but no improvement was noted. Three months later the patient was evacuated to the U. S. Naval Hospital, Oakland, Calif., with a provisional diagnosis of meningitis.

¹ TAGER, M. J.: Personal communication

On admission to this hospital the patient's temperature was 102° F. and his blood pressure 174/86. He showed generalized wasting, left ankle clonus, and intention tremor of both hands. X-rays of the chest taken by portable machine revealed no abnormalities. The blood count showed a secondary anemia with a moderate leukocytosis. The differential count was not noteworthy. Prothrombin time was 72 seconds. All specific agglutination tests done on the blood throughout the hospital course yielded negative results. The cerebrospinal fluid cell count ranged from 0 to 102 with a preponderance of lymphocytes on repeated examination. The sugar was constantly low, ranging from 20 to 30 mg. percent, and the protein ranging from 50 to 75 mg. percent. The Wassermann was negative and the colloidal gold on repeated examination showed the same essential picture, namely 55555-4431.

The patient was seen in the neurologic service and the opinion was expressed that there was a brain abscess in the cerebral hemisphere but that surgery was contraindicated. Encephalographic examination showed no significant filling of the subarachnoid spaces. The ventricles were well filled, although there appeared to be masses in the region of the choroid plexus in both ventricles. The tentative diagnosis was internal hydrocephalus.

Approximately 15 days after admission a mass 7 cm. by 3 cm. appeared over the lower right part of the chest in the anterior axillary line. Two days later another mass appeared above the clavicle on the left side. Both lesions broke down and ulcerated, discharging a thick yellow purulent material. Smear and culture of the exudate from the superficial abscess above the clavicle and of the cerebrospinal fluid demonstrated *Coccidioides immitis*.

Treatment.—On admission sulfadiazine in adequate doses was administered for 6 days without improvement in the patient's condition; in addition supportive treatment was maintained. Because of a partial stricture of the esophagus, he required repeated saline and plasma infusions together with transfusions of whole blood. The superficial abscesses were drained surgically. In the hope of evaluating the efficacy of penicillin in this disease, it was employed both intravenously and intrathecally soon after the diagnosis was confirmed. It was administered intravenously by continuous drip method and by venipuncture. Ampules of 100,000 Florey units were dissolved in 30 cc. of sterile distilled water. The total amount received by the patient was 3,081,000 Florey units, 500,000 units being given intrathecally.

The patient's clinical course was progressively downhill; the temperature fluctuated throughout the illness, and at no time was marked improvement shown. The patient expired 16 August 1943, 4 months after symptoms were first noted.

Autopsy findings.—The characteristic findings of a longstanding chronic infection were noted. The mediastinal and abdominal lymph nodes were enlarged, necrotic, and many of them were liquefied. The esophagus was involved in a destructive necrotic process causing a partial stricture. The lungs presented a diffuse coccidioidomycosis infection with a terminal bronchopneumonia. The brain was large, edematous, and pale, with a tenacious fibrinopurulent exudate covering the base. An internal hydrocephalus was observed with dilatation of the lateral ventricles. The masses within the ventricles proved to be due to edema and swelling of the choroid plexus on each side. The meninges were markedly congested and edematous. The spleen was enlarged, firm, and diffusely involved.

Microscopic examination showed a heavy infection of double contoured *Coccidioides immitis* with the characteristic granulation tissue reaction of chronic coccidioidomycosis. The brain lesions exhibited subacute involvement with little evidence of a destructive process. The left epididymis was also involved. In addition a marked toxic hepatitis was noted.

COMMENT

After the diagnosis had been established in this case, the patient was questioned as to his whereabouts during the years preceding his enlistment, and it was ascertained that he had lived for 7 years in an endemic area when he was employed by an oil firm operating in the San Joaquin Valley. From this locality he frequently made trips into rural areas. No definite history of primary infection could be elicited. Nevertheless one might speculate upon the patient's actual physical condition at the time of his induction. That he was in the latent or subclinical period at this time is highly probable. Ordinary physical examination would therefore be inadequate. No skin tests were performed. Certainly it is unlikely that the disease could have developed in a nonendemic area in so short a time. Fennel² however reported an instance of coccidioidal granuloma in a Hawaiian who had never been out of the Hawaiian Islands.

Adequate doses of penicillin were administered. Not only was the clinical course unaltered, but the growth of the organism in the cerebrospinal fluid was uninhibited.

SUMMARY

1. A case of coccidioidomycosis was treated by 3,081,000 Florey units of penicillin without inhibition of growth, or alteration of clinical symptoms.
2. The patient developed his first symptoms while stationed in a non-endemic area. He had however lived for 7 years in the San Joaquin Valley prior to his enlistment in the Navy.

² FENNEL, E. A.: Coccidioidal granuloma in Hawaii. Proc. Staff Meet. Clin., Honolulu, T. H., 1, No. 9, 1935.



A NEW ANTACID IN ULCER THERAPY

Forty cases of peptic ulcer were treated with a new antacid tablet composed of 1.6 gm. of calcium caseinate and 0.4 gm. of calcium carbonate.

Eighty-seven percent of the patients were relieved of their symptoms and experienced no recurrences during the time they remained under treatment.

The preparation is very palatable. Several times when the tablets were unavailable, other antacids were substituted temporarily. All of the patients expressed a desire to resume the tablets as soon as they became available.

No limiting factors for the use of the new antacid are to be anticipated, as no untoward effects were noted.—MARSH, H. E.: Treatment of peptic ulcer with new antacid. Jackson Clin. Bull. (Madison, Wis.) 38-41, March 1944.

NEURINOMA OF THE MENTAL NERVE

REPORT OF CASE

BRUNO E. AMYOT

Lieutenant (DC) U. S. N. R.

A comprehensive search of recent literature has failed to reveal any information on the occurrence of a neurinoma of the mental division of the fifth nerve. Little has been written on the appearance of this tumor in the seventh nerve, and few cases of neurofibroma of the oral cavity have been reported.

Case report.—A 20-year-old Negro mess attendant a year previous to his visit to the dental dispensary had received a blow on the chin in a fist fight. A few days later, while eating, he experienced pain in the apical area of the lower incisor teeth, soon after which he noticed a small firm lump on the inside of his chin at the midline. In three months this swelling slowly increased in size to that of a walnut and according to the patient remained constant thereafter. He experienced no pain and seemed not to be inconvenienced in eating.

X-ray examination revealed a depression in the bone of the mental area of about $\frac{3}{8}$ inch, $\frac{1}{4}$ inch below the crest of the alveolar ridge to the lower border of the mandible.

The tumor had a rubbery consistency simulating fluctuation. A large-bore needle was used to explore the contents of the mass, but no fluid was obtained.

Anesthesia was obtained by right and left mandibular block injections of 2-percent novocain. The tissues over the tumor were prepared and a vertical incision made through the mucous membrane in the midline. By careful dissection the mucous membrane was separated exposing the grayish growth. Dissection was continued until the mass was free from its bony crypt and surrounding soft tissues. The growth shelled out quite easily except for a pedicle-like attachment at the lower border of the symphysis.

There was considerable hemorrhage from the mental arteries. These bleeders were ligated with five No. 000 chromic sutures, and bleeding from the bone whose periosteum had been absorbed due to pressure from the growth was controlled by packing the cavity with iodoform gauze. Two fine silk sutures were taken to approximate the mucosal edges at the line of incision leaving a small opening for the removal of the gauze pack.

The patient was admitted to the dispensary where ice bags were applied to the face and mild sedatives given. He experienced no postoperative pain or rise in temperature. There was loss of sensation only in an area about one centimeter square just left of the midline of the chin. The patient was discharged from the dispensary to light duty after the sutures were removed on the second postoperative day. On the fourth postoperative day a few inches of the gauze were removed and this process continued every other day until all had been removed. Closure of the wound was rapid and uneventful.

The laboratory studies were as follows:

Gross.—The specimen is a well encapsulated irregular mass which measures 2.5 by 2 by 2.5 cm. It has already been cut in the midline and there is a bulging of the parenchyma from the cut surface. The surface cuts with firmness. The cut surface is uniformly whitish-yellow in appearance with a few areas of hemorrhage.

Microscopic.—Section shows a large nerve fiber and its sheath passing along one border. The neurilemma has proliferated and given rise to a whorl-like mass and interlacing bundles of sheath cells.

Pathologic diagnosis.—Neurilemmoma or neurinoma of mental nerve arising at the site of old injury.



EFFECT OF ULTRAVIOLET IRRADIATION ON BACTERIA

Ultraviolet irradiation, when applied by the Knott technic to:

(a) bacteria suspended in a buffered peptone water had a slight bactericidal effect which varied according to the kind of bacteria subjected to irradiation;

(b) bacteria suspended in blood, exerted a negligible bactericidal action;

(c) bacteria in buffered peptone water or blood, never killed all the organisms present;

(d) toxins in saline, had a slight detoxifying action on tetanal and diphtherial toxin, but not on staphylococcal toxin or scarlet fever streptococcal toxin;

(e) toxins in blood, exerted no detoxifying action; and,

(f) the four toxins tested, including tetanal, never completely inactivated them.

Guinea pigs surviving a single minimal lethal dose of diphtherial toxin developed an area of necrosis 1.0 cm. in diameter at the site of injection; while those surviving a similar irradiated dose developed an area of necrosis 3.0 cm. in diameter.—BLUNDELL, G. P.; ERF, L. A.; JONES, H. W.; and HOBAN, R. T.: Observations on effect of ultraviolet irradiation (Knott technic) on bacteria and their toxins suspended in human blood and appropriate diluents. *J. Bact.* 47: 85-96, January 1944.



DUNCAN'S HYPEREXTENSION OF THE SPINE

With the patient in the supine position the legs are allowed to hang over the end of the examining table (as in the Walsher position), thus tending to produce an increase in lumbar lordosis. In a typically positive test, there is first a latent period of from one to two minutes during which time the patient is free from pain; this is followed by a steadily rising tide of peripheral pain. Flexion of both extremities on the trunk usually affords complete relief of this pain.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

NORMAL BLOOD ELEMENTS AND LEPTOSPIRA

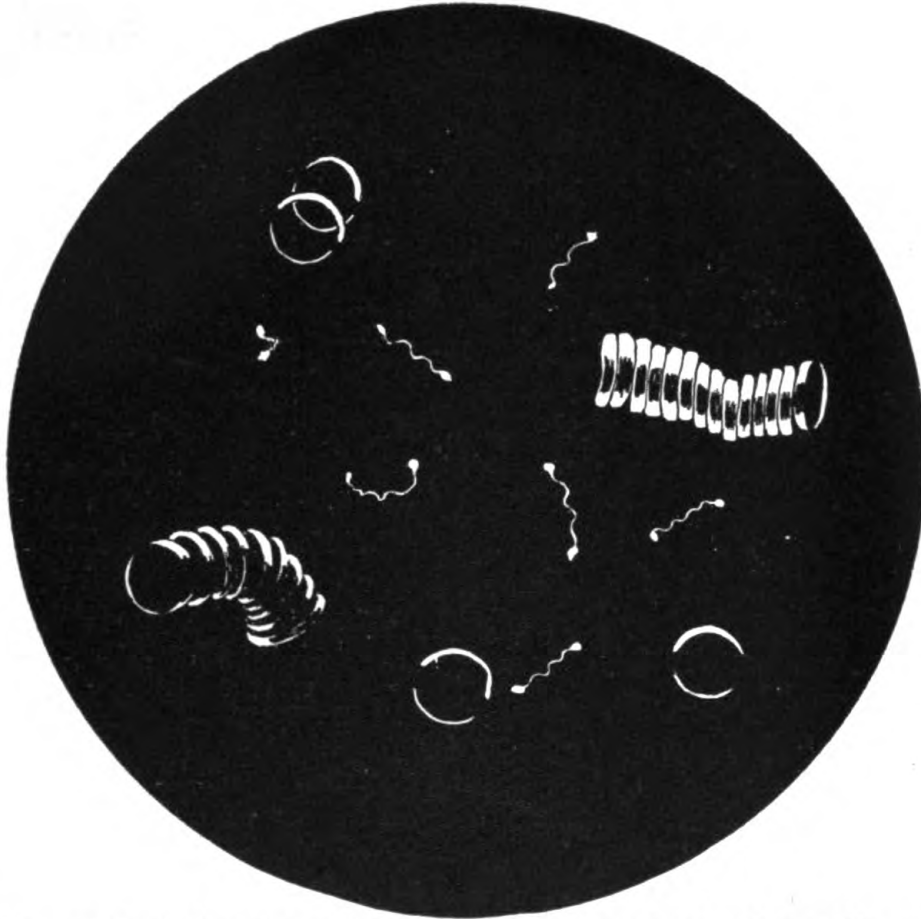
LOUIS SHATTUCK BAER
Lieutenant (MC) U. S. N. R.
and
RALPH F. ALLEN
Lieutenant (MC) U. S. N.

It should be borne in mind that there are "motile" filaments in normal blood which closely resemble leptospira. The finding of these apparently living, motile, spiral forms during the darkfield examination of the blood of a patient suspected of having Weil's disease has occasionally proved misleading even to those trained in microscopy and epidemiology. No mention of the danger of mistaking these filaments for leptospira is made in seven of eight available standard textbooks on internal medicine, tropical diseases and public health. However, Wood, in the 1943 edition of Cecil's Textbook of Medicine, calls attention to this differentiation and many articles have appeared in the literature emphasizing the confusing nature of so-called "pseudospirochetal" forms.

These normal blood filaments were found to be present in more than 90 percent of the blood specimens examined here by the darkfield method, which is in agreement with previously reported findings. These filamentous forms are wavy, extremely tenuous, actively "motile," and measure about 6 to 12 microns in length. They frequently have bipolar knobs which can be mistaken for the terminal hooks of leptospira. Their motion is probably a combination of Brownian movement and currents in the fluid being examined. It is similar to the movement of leptospira. At times the blood is teeming with these forms.

These filaments probably originate from destroyed red blood cells and blood platelets. Our observations also confirmed that they cannot be cultivated in artificial media that will grow leptospira, nor do they cause disease when injected into the guinea pig or mongoose.

In fifty centrifuged normal urine specimens no "filaments" were found. However in one patient with hematuria these forms were present in abundance. This is important, for in patients with Weil's disease (in which hematuria is common) darkfield examination of the urine for the presence of leptospira will be of limited value because of the same element of confusion that exists in examination of blood



Normal blood elements, probably originating from destroyed red cells and platelets, which can easily be confused with leptospira.

specimens. The laboratory diagnosis of Weil's disease by darkfield examination of blood or urine is therefore a hazardous procedure. Whenever possible guinea pig inoculation and specific agglutination tests should be done.



CHANGES IN REFLEXES

The most common abnormality found on neurological examination of patients suffering from herniated disc is diminution or absence of the achilles reflex on the affected side. This phenomenon has been reported to occur in as many as 80 percent of herniated disc lesions. Diminution in the knee reflex occurs much less frequently. Absence of an achilles reflex suggests a lesion at the lumbosacral space or the fourth lumbar space, while absence of a knee jerk is an indication that the lesion is at or above the third lumbar space.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

PROGRESSIVE MUSCULAR DYSTROPHY

REPORT OF A CASE

TULLY T. BLALOCK

Lieutenant (MC) U. S. N.

There are in the service a certain number of men whose physical disabilities escaped the attention of the medical examiner at the time of their induction, but who actually harbor a disabling infirmity which renders them unfit for military life. Such conditions as asthma, hay fever, effort syndrome, and psychoneuroses are representative examples. The case presented here may also be classified in this group. The patient had been found physically qualified in two examinations yet he was definitely not capable of performing military duty and had he been inducted into active service would have been a menace to himself and his shipmates.

Case report.—The patient was a V-12 trainee, aged 19 years, with a history of no familial or congenital physical defects. He had apparently had a normal development in infancy, walking at 1 year of age. There was no evidence of any disability until he was 9 years' old. At that time he states that he could not run as fast as his playmates, but did not attach any significance to this. He remembers that his arms were not noticeably weak at that age.

At 13 years of age he noticed a perceptible weakness of his arms and could lift only 15 pounds. He still noticed an inability to run fast. Two years later, when he was 15, he noticed that he was unable to chin himself and that he could not perform even one deep knee bend. He began taking corrective exercises but noticed very little if any improvement. At 17 years he entered military school where he was forced to participate in calisthenics and athletics. It was observed that he could not maintain a double-time pace and that he could not perform the rudimentary calisthenics. On the theory this was due to muscular underdevelopment he began an intensive course of corrective exercises but the condition did not improve. When he was examined for entrance into the V-12 program he was found physically qualified; in fact at this time he was a fine looking specimen of a young man with no apparent physical defects.

Two months later he entered a Navy V-12 unit where he was again found physically qualified for active duty. Several weeks after reporting for duty he was subjected to the standard Navy strength test. The average trainee makes a score of 55 percent on this test. The patient's score was 0, and he was placed under medical observation.

At first glance the patient appeared to be a normal, well developed male; however on closer observation he was found to have a rather marked atrophy of the muscles of the shoulder girdle and upper arm. His biceps, pectoral muscles, and latissimus dorsi were practically nonexistent. There was a demonstrable atonia of the muscles of the abdominal wall. In the lower extremity there was

a deceptive pseudohypertrophy of the muscles of the thigh and calf; actually the muscular tissue of the lower extremities was functionally deficient.

When placed in a prone position, the patient could not raise his body from the floor. While lying on his back he could not sit erect without assistance. When asked to run he could not get above a fast walk. He could perform a deep knee bend only by a rebound process. His upper arms remained soft and flabby even when an attempt was made to contract the biceps. There was absence of patellar and Achilles reflexes with a weak response from the reflexes of the upper extremities. There were no sensory changes.

Routine blood tests and urinalysis were essentially normal, as were results of blood and urinary creatinine tests. Fasting blood sugar was 85.1 mg. percent, with a maximum rise to 168 mg. percent in 1 hour on a glucose tolerance test. The basal metabolism rate was plus 12 percent and plus 15 percent on two occasions. The electrocardiogram was normal.

The patient stated that he believed he had shown no progress in muscular development since beginning his corrective exercises 4 years ago; rather there had been a gradually increasing weakness.

COMMENT

Progressive muscular dystrophy is a disorder of muscles presumed to be due to some primary degenerative process within the muscle tissue. An attempt has been made to correlate the disease with the presence of some lesion within the central nervous system; in fact there are some who regard progressive muscular dystrophy as a stage in amyotrophic lateral sclerosis; however no evidence has been produced that a central nervous system lesion exists in progressive muscular dystrophy. This disease may be divided into three major groups:

1. Pseudohypertrophic muscular dystrophy.
2. Dystrophy with normal muscle size.
3. Atrophic muscular dystrophy.

The case presented here falls into two of these groups. There is atrophy of the muscles of the upper extremities and shoulder girdle with pseudohypertrophy of the muscles of the lower extremities.

The cause of progressive muscular dystrophy remains obscure; however it is recognized that hereditary and familial factors play a dominant role. Fifty-four percent of the cases reported show a familial tendency. The disease is thought to be transmitted by a sex-linked recessive characteristic, and there are reports of the entire offspring being affected. This patient has no brothers or sisters and the disorder was not present in either his parents or his grandparents.

Muscular dystrophy occurs most frequently in the first decade of life, usually at 4 to 6 years of age. Its progress is slow but may be extremely rapid, terminating fatally within a few years. When the onset is within the first decade of life, the average yearly loss of mus-

cular function is 13 percent and the patient may die of an intercurrent infection, usually pneumonia. When the disease does not appear until the second decade, progression occurs at a slower rate, the muscle power diminishing about 7 percent each year. The interesting feature of the case presented here is that although the patient's disease appeared within the first decade, his muscular degeneration has apparently diminished and is now in a more or less static stage.

The pathologic changes are limited to the muscle tissue. The fibers show early swelling followed by the appearance of vacuoles containing fat. Eventually there is a replacement of the entire muscle substance by fat and fibrous tissue. In the pseudohypertrophic form there is an overabundance of this fat which gives the muscle the appearance of being overdeveloped.

It has been observed that creatine plays a part in muscular metabolism. With this in mind an effort was made to determine the relative state of creatine-creatinine metabolism in persons suffering from progressive muscular dystrophy. In many of these patients creatine appeared in the urine. Under normal conditions creatine undergoes a change into creatinine before excretion by the kidneys. In muscular dystrophy this change may not be completed, probably because of failure of metabolism within the muscle. In the patient discussed here the 24-hour creatinine excretion was normal and there was no evidence of creatine in the urine. The blood creatinine was normal.

There was no obvious endocrine disturbance in this patient. He had a normal sexual development.

It is interesting to speculate on the state of the cardiac musculature in progressive muscular dystrophy. In those cases in which it has been possible to examine the heart, different observers have reported varying pictures. Certainly in isolated incidences the cardiac musculature has undergone degeneration similar to the skeletal musculature. Electrocardiographic study of this patient revealed a normal cardiac function.

The treatment of progressive muscular dystrophy has been uniformly disappointing. The use of glycine, a precursor of creatine, has been felt by some to bring about a slowing of the muscular degeneration, but apparently had no permanent or curative effect. Recently vitamin E in the form of alpha tocopherol has offered some hope. Doses of 50 to 150 mg. daily, combined with therapeutic doses of vitamin B₁ and pyridoxine have shown transient improvement in ergographic studies of muscle function. The crude wheat germ is felt by some to be superior to the synthetic product.

Abuse of the muscles by vigorous exercise in an effort to bring about development is unwise. This patient has been advised to discontinue all attempts at muscle building and to live a sedentary life.

A word should be spoken in support of the use of the reflex hammer in routine physical examination for entrance into the service. The positive findings in this patient were limited to the absent patellar and Achilles reflexes, along with the less apparent muscular atrophy. In the urgency of a mass examination, there may be a natural tendency to overlook the reflexes in an apparently normal individual.

SUMMARY

A case is presented of a 19-year-old V-12 trainee with a diagnosis of apparent progressive muscular dystrophy which was not observed in two physical examinations. The patient has survived and his disease is apparently in a static stage.

More frequent use of the reflex hammer in routine physical examination is advised.



STRAIGHT LEG-RAISING TEST

With the patient in the recumbent position, the extended lower extremity is raised. The excursion of the extremity from the horizontal position to the position in which the patient first complains of backache, sciatic pain, or painful tightness of the hamstrings, marks out an arc which is recorded in degrees. During the test the leg must remain completely extended. The limitation in straight leg raising is recorded in degrees for both extremities. Inequalities in the value on the two sides are of greater significance than an apparently diminished value when the painful side only is tested, since the excursion varies with age and degenerative processes such as arthritis and previous trauma, and depends upon individual mobility.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.



DUNCAN'S ALTERNATE PUSH AND PULL TEST

Upward pressure on the painful leg with traction on the painless leg should increase the pain in the back, and the reversal of the procedure, i. e., traction on the painful leg and upward pressure on the painless leg should lessen or relieve the pain. The test is based on the fact that lateral flexion of the spine thus produced will usually effectively compress or decompress a lesion, and thus increase or decrease the pain as the case may be. Especially is this so if the lesion is lateral in position.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

INFLAMMATION OF THE MACULA LUTEA

REPORT OF A CASE

ALBERT J. BRINCKERHOFF

Lieutenant (MC) U. S. N. R.

Macular disease or degeneration among young adults is a rather rare entity. However, its presence among Naval personnel is not so uncommon as might be expected. This may be due to the fact that the visual acuity of the officers and men is constantly being tested, both in physical examinations and war operations, resulting in the discovery of a greater number of early cases.

In the author's experience cases have been seen from the submarine service, deck services, shore-based maintenance units, and communication offices. No common denominator of occupational exposure or dietary deficiency was evident. This would tend to indicate that the disease is not influenced by service conditions.

The most common affliction of the macula in young adults exclusive of those of a definite hereditary nature have an inflammatory, vascular, or traumatic basis. Trauma may be from physical violence or concentrated light rays.

The macula becomes edematous easily and consequently responds readily to trauma and the toxins of associated ocular inflammation.

The response of the macula to these insults results in the following conditions, many of which end in destruction and a permanent central scotoma.

1. An exudative choroiditis in the central area is usually severe and ends in a white, irregularly pigmented area of varying size.

2. Cystic macular degeneration causes a hole in the retina exposing the choroid.

3. Central angiospastic retinopathy produces a swelling of the macula which is usually transient and has a good prognosis for sight.

4. Juvenile disciform degeneration of the macula (juvenile macular exudative retinitis of Junius) is probably a subretinal serous exudate resulting in macular edema and temporary central scotoma. The prognosis is good. Should the exudate consist of blood, as it does in the senile cases, healing is more liable to produce scar tissue with permanent loss of vision.

CASE REPORT

The patient's reporting complaint was a gradual diminution of vision in the right eye over a period of 2½ months with a rapid decrease in the last 2 weeks.

He had been examined just prior to the last sudden change, at which time his vision was R 12/20, L 14/20, and with his myopic correction the vision was R 20/20 with difficulty and L 20/20. The examination of the eyes was negative including the fundi and the right eye vision was improved with the addition of a -0.25 sphere to his glasses.

He returned 2 weeks later stating that the vision of the right eye had deteriorated rapidly. In fact it had dropped to 2/20 corrected to 14/20. The symptoms were those of a central scotoma.

The family history was negative and his past history was devoid of positive information. The patient's duties were those of a communications watch officer ashore and there was no history of physical violence or actinic trauma.

The physical examination revealed a 24-year-old male apparently in good health. He was quite disturbed over his condition. There was an anxiety of speech and copious perspiration. The general physical examination was negative. The urine was negative for albumin and sugar. The blood Kline reaction was negative as were intradermal tuberculin tests with 0.00002 mg. and 0.005 mg. of P. P. D.

Examination of the eyes revealed a vision of R 2/20, L 14/20 corrected to R 14/20 and L 20/20. Retinoscopy under homatropine measured R -1.50 sphere, L -1.25 sphere. The blurring of the vision was due to a central scotoma roughly circular in shape extending 2 degrees in all directions from the point of fixation when measured by a 2 mm. white object at 1 m. distance. Both lids were normal, corneas clear with no keratic precipitates, irides reacted to light and accommodation, lenses were clear and the vitrea contained no floaters. The fundus and macula of the left eye were normal. The fundus of the right eye was normal except for the macula. There was no inflammation of the disc. An exudate resembling a drop of gray wax covered the macula to the edges of the usual area of increased pigmentation. This exudate was surrounded by a border of hyperemia. The surface of the exudate was raised one diopter.

The patient was hospitalized and placed on 1/100 grain glyceryl trinitrate twice a day, nicotinic acid 50 mg. 3 times a day, and thiamine chloride 5 mg. 3 times a day. After a week, fever therapy was given twice, using typhoid vaccine intravenously. The fever shocks were separated by a two-day interval. On both occasions his temperature rose to 103° F. for periods of about 1 hour.

The exudate cleared in 3 days after the last fever treatment, leaving a macula with a slight irregularity in the pigment distribution. There was no immediate functional improvement. However, 5 days later the patient's vision began to improve and after a period of 10 days the corrected vision had returned to normal. There was no measurable scotoma present but a little metamorphopsia remained.

The patient was discharged to duty after a month's hospitalization and was directed to continue the same doses of thiamine chloride and nicotinic acid for another month.

One month after discharge the vision of the right eye was 10/20 corrected to 20/15 with no distortion of the letters. The fundus still showed the slight irregularity of the pigment at the macula.

This case might be classed as a juvenile macular exudative retinitis of Junius. These cases usually terminate without permanent injury to sight, but active therapy is indicated to increase the blood supply to the macula and strengthen the defensive powers of the tissues.

The majority of the cases we have seen are of a degenerative type and probably would not respond so readily to treatment. However since toxins are felt to be an etiologic factor even in degenerations, active treatment to eradicate foci and support the macula is indicated.

All men with ocular complaints should be given the benefit of a specialist's examination. The differential diagnosis of beginning scotoma and refractive errors is difficult to make and requires the use of special apparatus.

A thorough investigation into the histories and findings of the present group of cases in the Navy might lead to the discovery of some common cause and some useful form of therapy.



THERAPY IN CONGESTIVE HEART FAILURE

Digitalis and its glycosides restore the normal output by depressing conduction from the auricle to the ventricle and so reducing the number of impulses which reach the ventricle. The ventricular rate is slowed, and the ventricle has time to fill. Digitalis, however, has another action: it increases the force of contraction of the cardiac muscle. When this action is demonstrated on a normal heart muscle it is small and not impressive; in muscle which is damaged, however, it is much greater.

Strophanthin is used for patients with heart weakness and normal rhythm. It is given intravenously and has a similar action to digitalis, but it is not cumulative, so that the injection can be repeated every other day. Fraenkel used 1/240 grain (or 0.25 mg.). One of his more remarkable charts showed the loss of 15 lb. oedema fluid in a patient to whom he gave strophanthin, despite the existence of arteriosclerosis, a heart rate of 40 per minute, and complete heart-block.

There are many patients who after an attack of pneumonia or bronchitis continue to suffer from congestion at the base of the lungs for some time. A careful trial of digitalis in the form of leaf or tincture, or as the crystalline glycoside digoxin, should certainly lead to more rapid disappearance of the congestion.

Observations also have been made on the effect of theophylline diethanolamine on the cardiac output and of coramine and metrazol or cardiazol. None of these substances affected the cardiac output of patients with congestive heart failure, and the only substance which produced any effect at all was theophylline, which in a dose of 0.2 g. given intravenously caused a slight increase in the oxygen consumption. It is excellent to have clinical evidence from patients with heart failure that these substances do not act as cardiac stimulants.—Editorial. Digitalis in congestive heart failure. Brit. M. J. 1: 429, March 25, 1944.

IMPETIGO CONTAGIOSA CURED BY FEVER

REPORT OF A CASE

OSCAR GREENE

Lieutenant Commander (MC) U. S. N. R.

The following is reported on account of the prompt and favorable reaction seen in a case of impetigo, this reaction following upon an intercurrent pyrexia.

An aviation machinist's mate, second class, was admitted to the hospital with the diagnosis of impetigo contagiosa. The characteristic findings included discrete thin-walled vesicles about the lips, which rapidly ruptured and exuded a thin straw-colored fluid and when dry formed yellowish, loosely stratified crusts. The history of the pruritus and appearance of the eruption was of 24-hours' duration. On admission the patient's temperature was 98.6° F., results of urinalysis were negative, the erythrocyte count was 4,120,000 and the leukocyte count 5,500 with 72 percent segmented cells and 27 percent lymphocytes. Blood smears were negative for malaria.

The patient's health record revealed that he had been treated for benign tertian malaria 8 months previously and returned to duty well. Five days before the present admission, however, he had again had a severe chill. Six weeks prior to admission he had been given a routine course of sulfathiazole therapy for acute gonococcal urethritis and was discharged to duty well 10 days later. Results of physical examination throughout the patient's hospital stay were negative.

Treatment was begun by the local application of a 10-percent sulfathiazole ointment. On the day following admission the patient experienced a shaking chill and had a fever of 104.2° F. This lasted approximately one hour. One-half hour after onset of the chill, the lesions about the lips suddenly changed to a mulberry red color. Sulfathiazole ointment was discontinued and no other medication, local or oral, was given. The pruritus immediately ceased, the temperature remained normal, and the local eruption gradually disappeared. The patient was returned to duty 5 days later entirely well.

In view of the patient's previous history of malaria as well as a history of shaking chills 5 days before admission, his fever might be attributed to malaria. However the possibility of an allergic response to the use of sulfathiazole, producing the fever and changing the skin picture, cannot be overlooked. The fact that a case of impetigo contagiosa ceased spontaneously after the fever leads to the speculation that fever, natural or induced, may possibly be of value in the therapy of that disease.

MULTIPLE CHANCRES

A CASE REPORT

LUCIAN W. DiLEO

Lieutenant (MC) U. S. N. R.

and

FRANCIS T. KELLY

Lieutenant (MC) U. S. N. R.

The tendency to multiple chancres in primary syphilis is well known (about 25 percent of all genital chancres are multiple), but this case is considered worth reporting in that there are 7 chancres, all on the shaft of the penis, none on the glans penis.

Chancres of the shaft are comparatively rare. The penile chancre may occur any place on the organ, but is usually situated in the coronal sulcus, region of the frenum, preputial margin, on the coronal margin or the dorsal surface of the glans.

CASE REPORT

The patient, a seaman first class, 21 years of age reported to the sickbay with a chief complaint of "sores on the penis" which he noticed 2 days previously. They all appeared within a period of about 24 hours. There was a history of exposure 14 days, 16 days, and 20 days prior to the day he noticed the sores. On each occasion he used the ordinary rubber sheath, but on the last occasion the sheath tore and he completed the act with the torn sheath on his penis. The last exposure prior to the ones mentioned above was 6 months previous to admission.

The patient was sent to the laboratory for darkfield examination. All lesions were positive for *Treponema pallidum*. Because of the rarity of this case, the patient was sent to another laboratory and the previous findings were confirmed. Kahn was negative at that time.

Examination of the genitalia revealed 7 ulcerated lesions on the dorsal and lateral surfaces of the shaft of the penis. They were saucer-like with clean cut edges and slanting, dull red floors somewhat glazed, with a little exudate. The edges were raised and induration was noted in all the lesions. The lesions were painless to touch and pressure. They were about 1 to 1½ cm. in diameter. There was a swelling of the inguinal lymph nodes which were discrete and hard. There were no other significant findings.

Five days after admission, 0.06 gm. mapharsen and 1½ cc. bismuth were given. This dosage was repeated every third day for a total of 6 administrations. The lesions disappeared following this therapy. Kahn test 5 days later was 4 plus.

COMMENT

The significance of a chancre is that it is the primary site of inoculation of the *Treponema pallidum*. With this in mind it is interesting to note the probable mechanism of inoculation in this case. It is theo-



Multiple chancres on shaft of the penis. •

retically possible that when the sheath tore (and the patient continued the sex act) the torn sheath abraded the skin in multiple areas, causing him to be inoculated in several of the abraded areas with the result that he developed seven separate chancres.



NAFFZIGER TEST

This is a modification of the straight leg-raising test. With the patient in the recumbent position, the foot is forcibly dorsiflexed on the leg. As the extended extremity is raised, this dorsiflexion of the foot further stretches the sciatic nerve and causes increase in the backache and pain along the posterior thigh. This test is usually positive at an angle of elevation 5 to 10 degrees less than the straight leg-raising test, and is useful to confirm the findings of the straight leg-raising test.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

MEDICAL AND SURGICAL DEVICES

ANTICONCUSSION EAR PLUGS

PREVENTION OF AURAL COMPLICATIONS FROM GUNNERY CONCUSSION

LAWRENCE K. COX
Lieutenant (DC) U. S. N. R.
and
JOHN W. GELLER
Lieutenant (DC) U. S. N. R.

There has been a great deal of experimentation with devices for the prevention of aural injury caused by gunnery concussion. Cotton and rubber swimming plugs are commonly used, both of which are an aid but are not completely concussion proof. For some time gunnery schools have been handicapped because of the lack of a suitable ear plug. It has been necessary to rotate the officers and instructors at frequent intervals because of ear drum irritation. Because of this constant change the efficiency of the ranges has been reduced.

Past experience has proved the inefficiency of cotton as a suitable resistant to high frequency noises. Cotton does not eliminate ringing, numbness, soreness, and gradual loss of hearing. Its use from a common container by the men on the ranges is a perfect means of carrying infection to the ears. As for the rubber swimming plug, the discomfort caused by its use is greater than its preventive qualities.

A suitable ear plug must meet the following requirements: (1) Be easy to keep clean; (2) have very little weight; (3) be unbreakable; (4) be easy to insert and have good retention; and (5) have the ability to admit ordinary conversation but exclude high frequency sounds.

The acrylic resin ear plug described here meets these requirements. These plugs are specially built for the individual ear and are the sole property of the man for whom they were made.

To determine the efficiency of the plug, five trials were made by experienced instructors chosen from different ranges. Following insertion of the plugs they remained on the ranges for 8-hour periods.

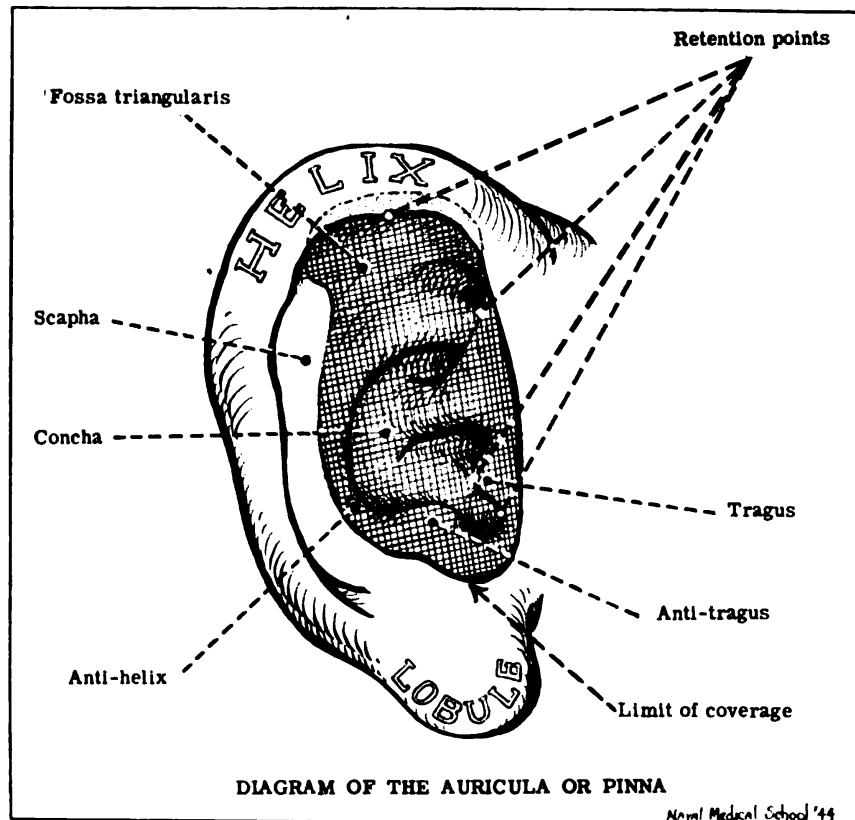


FIGURE 1.

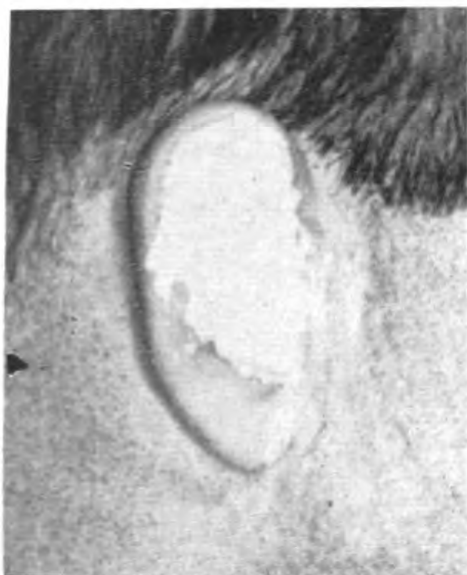
After the first week the following questions were asked each instructor individually and his answers recorded:

1. Was there any irritation from the ear plugs?
2. Was there any ringing in the ears after 8 hours on the line?
3. Were you conscious of the plugs?
4. Did you give the ear plugs a severe test?
5. Do you believe you could remain on the line for an indefinite period by use of the plugs?

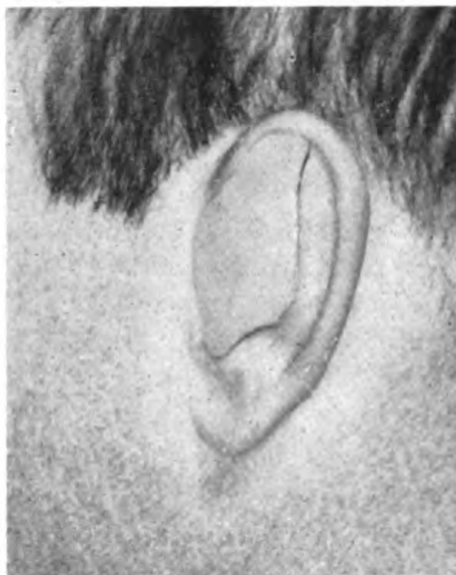
All replied that no irritation had been experienced and no ringing in the ears, that ordinary conversation was audible, and that after the first day the plugs were not noticeable. All had stood between two guns which were being fired and had experienced no irritation or reaction. All believed that rotation of instructors would not be necessary if such plugs were used.

After this initial experiment other men on the line were fitted with these plugs and the same questions were asked after weekly trial periods for 5 weeks. All gave essentially the same answers, except that they suggested that the plugs be extended farther into the ear canal and that a thin coating of white vaseline be used on the portion of the plug that enters the canal.

The plug is constructed to fit the auricle and the canal. The major portion of the plug fills the concave, ovoid portion of the auricle, covering the eminences and filling the depressions. It is molded to fill the fossa triangularis and the scapha down to the end of the curved prominence of the antihelix. It does not cover the lobule, the tragus, or the antitragus, but its smooth outer surface and lower border are flush with these structures as well as with the inner border of the helix. The portion which fills the concha extends inward and fills the auditory meatus to the extent of about one centimeter medially from the bottom of the concha, thus forming the seal and providing retention. Incidentally, with the marked decrease in meatal irritation, ear fungus infection is prevented by the use of this snug-fitting plug. Its trial in aeronautics is also suggested.



2. Showing the hydrocolloid impression of the ear.



3. The finished ear plug inserted.

Technic of construction.—With the gunner seated in the dental chair which is adjusted to a reclining position, and his head turned to one side, the ear canal is checked for dirt or excessive wax. The ear is then covered with a thin coating of mineral oil or other suitable lubricant, and a small pledget of cotton is placed about 4 or 5 mm. beyond the opening of the canal. The impression is then taken with one of the hydrocolloidal materials. Directions for its use should be followed carefully, using one-half tube of the material for each ear. The entire surface of the ear is covered within the borders of the helix and lobule. After the material has set it is removed carefully, cutting the cotton pledget away from the impression material which extends into the canal. The impression of the other ear is then obtained in the same manner. Plaster has been used as an impression

material without success. The hydrocolloidal material allows for accurate detail and ease of removal, thus permitting a further extension into the canal which aids in sealing and retention.

The two impressions may be invested in the same lower half of the flask. The canal portion of the impression is placed downward so that the face of the impression is flush with the surface of the plaster. Separating medium is then applied and the flasking is completed. After it has set, it is carefully removed and the surface painted with sodium silicate or other protective coating, dried and a second coating of protective medium applied.

Acrylic resin, either clear or pink, is used in casting the final plug. The material is packed into both dies, and before closure the lower half of the flask is covered with cellophane. It is again opened, more acrylic is added, the cellophane is replaced, and the halves again closed. This procedure is repeated if additional material is necessary. Before the final closure the owner's initials are cut into the upper part of the flask. The material can be processed in hot water, boiling for 1 hour, or in a vulcanizer for 1 hour at 320° C. Curing in a vulcanizer will aid in breaking down the plaster, thus facilitating its removal from the flask.

The plug is smoothed with finishing stones and sandpaper bands on the outer surface, polished with pumice, a buffing wheel and brush, washed and dried thoroughly. The gunner is instructed to apply vaseline around the canal portion of the ear plug before each insertion.



SULFAGUANIDINE FOR DYSENTERY

Forty-four young female adults, mainly symptomless carriers of *B. dysenteriae* (Flexner), were treated with massive doses of sulphaguanidine.

The bacteriological results were satisfactory after conclusion of treatment. Five consecutive negative results were obtained for each patient.

About the ninth day of treatment 21 patients developed a toxic rash. Apart from one circinate urticaria, the rashes were pink and morbilliform. The presence of a scarlatiniform and a petechial type was noted among the latter. There was no relation to a high blood concentration of the drug.

Eight patients out of 12 reacted to a sensitization dose of sulphaguanidine. In some cases the constitutional upset was severe. There was no response to sensitization doses of other sulphonamides. It is suggested that the guanidine radical may be the sensitizing agent.

The high incidence of toxic rashes suggests care in dosage.—
SMITH, H. G.: Sulphaguanidine in treatment of Flexner dysentery.
Brit. M. J. 287-288, February 26, 1944.

A SIMPLE NIGHT VISION TEST

LAWRENCE L. BEAN

Commander (MC) U. S. N. R.

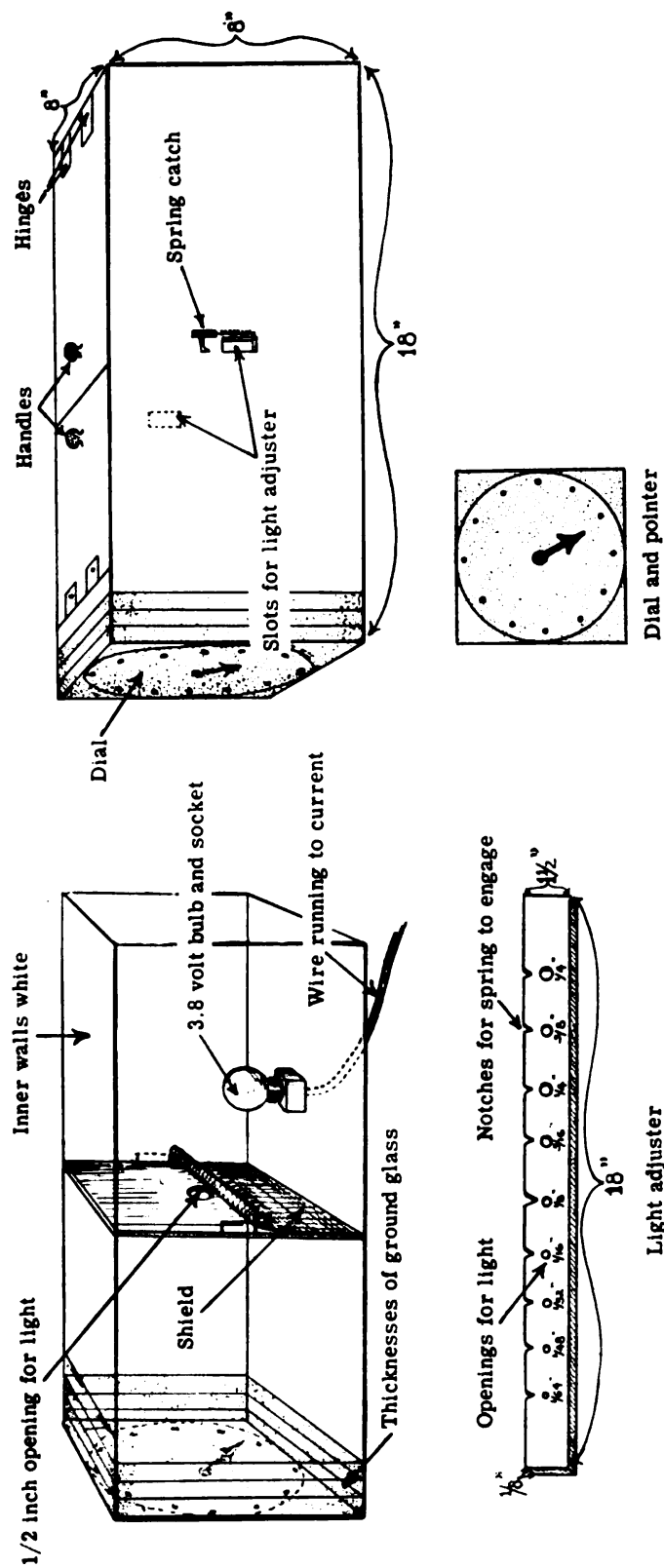
Devices for detecting the presence of enemy ships, planes and submarines have improved tremendously during the time we have been at war. However the keen vision of the human eye has not been replaced but has been merely supplemented by these inventions.

The ordinary daylight visual tests do not give an accurate estimation of the accuracy of vision at night. Various attempts have been made to test night vision, mostly by the British who were the first to recognize its value. A method was described several months ago which consisted of a number of V's on a transparent background. These were of varying intensity and the acuity of the vision was tested by the ability to determine the number of V's present. This was a step in the right direction and gave a positive or negative result, but did not allow for a fine gradation in the tests and presented no opportunity to determine whether there was any improvement in the same individual under varying conditions. Also Harman¹ had a disk spotting plan in which the result was determined in fractions.

The device described here consists of a lightproof rectangular box 18 by 8 by 8 inches, divided into 2 compartments by a partition which has an opening in the center $\frac{1}{2}$ inch in diameter. In the rear compartment is a shield to keep direct light from going through the opening in the partition. The walls of the compartments are painted white to give a reflected light, the source of which is a 3.8-volt bulb attached to the ship's current. This is better than using batteries as a source of energy as they vary in strength as time goes on. This was one of the reasons why early tests gave confusing results. The use of a rheostat to vary the intensity of the light has been tried but it also changed the quality of the light from white to red at low voltages.

The front compartment of the box is empty and is used only as a space for the conduction and dispersion of light from the opening in the partition. The face of the front is made of ground glass like an ordinary clock dial with one or two pointers. Additional thicknesses of ground glass are placed behind the face to diffuse the light. It would be ideal if the glass and candle power of the light could be

¹ HARMAN, N. B. : Measure of night vision. Brit. M. J. 1: 43, January 9, 1943.



Device for testing night vision.

Naval Medical School '44

measured accurately from a scientific standpoint, but from a practical standpoint it will be seen that this is not essential for the satisfactory conduction of the test. The top of each compartment should be hinged for convenience in getting to the interior. A lightproof slot is placed in each side of the box through which the adjuster passes. A spring catch to engage in the notches on the adjuster is placed on one side of the box.

The light adjuster is a piece of stiff metal $1\frac{1}{2}$ by $\frac{1}{8}$ by 18 inches. Holes are accurately bored in the metal, beginning in size at $\frac{1}{64}$ inch and grading upward with an increase of $\frac{1}{16}$ inch in diameter until $\frac{3}{8}$ inch is reached. Notches are placed over each opening with a large notch over every fifth one to aid in determining the location of the holes in the dark and also for the purpose of holding the adjuster in place by means of the spring clip on the side of the box.

The technic of the test is simple and can be given by any medical officer or corpsman after a few demonstrations. The important part is that results are the same when given by different individuals. As a test of this, 20 subjects were tested by 3 individuals and the percentage of difference was less than 5. All subjects are given the usual daylight visual tests first.

The persons to be tested are placed in a dark room for 20 to 30 minutes for the purpose of accommodation and then seated 6 feet in front of the dial. The adjuster is placed in the lowest position ($\frac{1}{64}$ inch) and the pointer on the face of the dial is moved to various positions and the subject asked to identify them. If he cannot do this the adjuster is pushed up another notch. This is continued until the subject can readily identify the pointer in any position. This is most easily mentioned in terms of time, as, for example, the pointer is at nine o'clock.

A variation of this, which cannot be controlled so easily but which creates interest and is of value to lookouts consists in the use of silhouettes of different types of ships and planes. These may be held in front of the upper part of the dial with the pointers turned down and the lower half covered.

The grading of the results of the tests is simple. Individuals who can identify the condition of the pointer through the lowest possible opening in the light adjuster are given a grade of 4.0, the next opening 3.9 and so forth. Any one having a night vision grade of less than 3.6 is relieved from his duties as night lookout until he has improved.

The normal expectancy for a large group of men is 80 percent with a grade of 4.0, and 5 percent with a grade of less than 3.6. If the results show a marked variation from this, revaluation of the system can be made up or down as the case may be. This would not be necessary if the source of light were constant in all places, but variation of the

current varies the intensity of light coming through the apertures and makes it necessary to determine the normal for each box in each locality. After a little experience this is easily done.

A series of the tests were made on board ship and worked out so well in actual practice that a checkup was done monthly. After the first series of tests was made all subjects making under 4.0 were given daily doses of vitamins A and D in the form of haliver oil containing 1,500 units of A and 7,500 units of D. They were also encouraged to eat more vegetables. A definite improvement was found in those with grades of 3.6 to 4.0 but those below that did not respond well. All of these first tests were made after the ship had been at sea for months, with fresh vegetables and milk unobtainable and eggs scarce. When the ship docked for 3 weeks there was a change in diet with an abundance of milk and fresh foods, following which there was a noticeable improvement. Some of this could no doubt also be attributed to the opportunity the men had for liberty, relaxation and freedom from tension, the first they had had for 8 months.

TABLE 1.—*Results of tests under varying conditions*

Grade.....	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.2	3.0
First test.....	71	10	8	4	4	3	2	1	2
Second test ¹	79	6	6	3	2	5	1	0	3
Third test ²	87	2	3	2	2	4	2	0	3

¹ Second test was given after 1 week of vitamins A and D.

² Third test was given after rest and fresh milk and vegetables.

There is no way with this test to determine malingerers. Harman² in his disk test claims to be able to detect them by variations in the disk sizes and in the intensity of the light. Unquestionably this element did enter into the picture, as one or two of the men were looking for an excuse to avoid this duty. From a theoretical standpoint this detracts from the reliability of the test but from the standpoint of the selection of lookouts who are responsible for the safety of the ship it is a success, as men of the malingerer type were not considered good material for such an important assignment.

² HARMAN, N. B.: Shamming night-blindness. Brit. M. J. 2: 737, November 22, 1941.

PROTECTOR SLEEVE FOR HYPODERMIC SYRINGE

TRUMAN O. ANDERSON

Lieutenant Commander (MC) U. S. N. R.

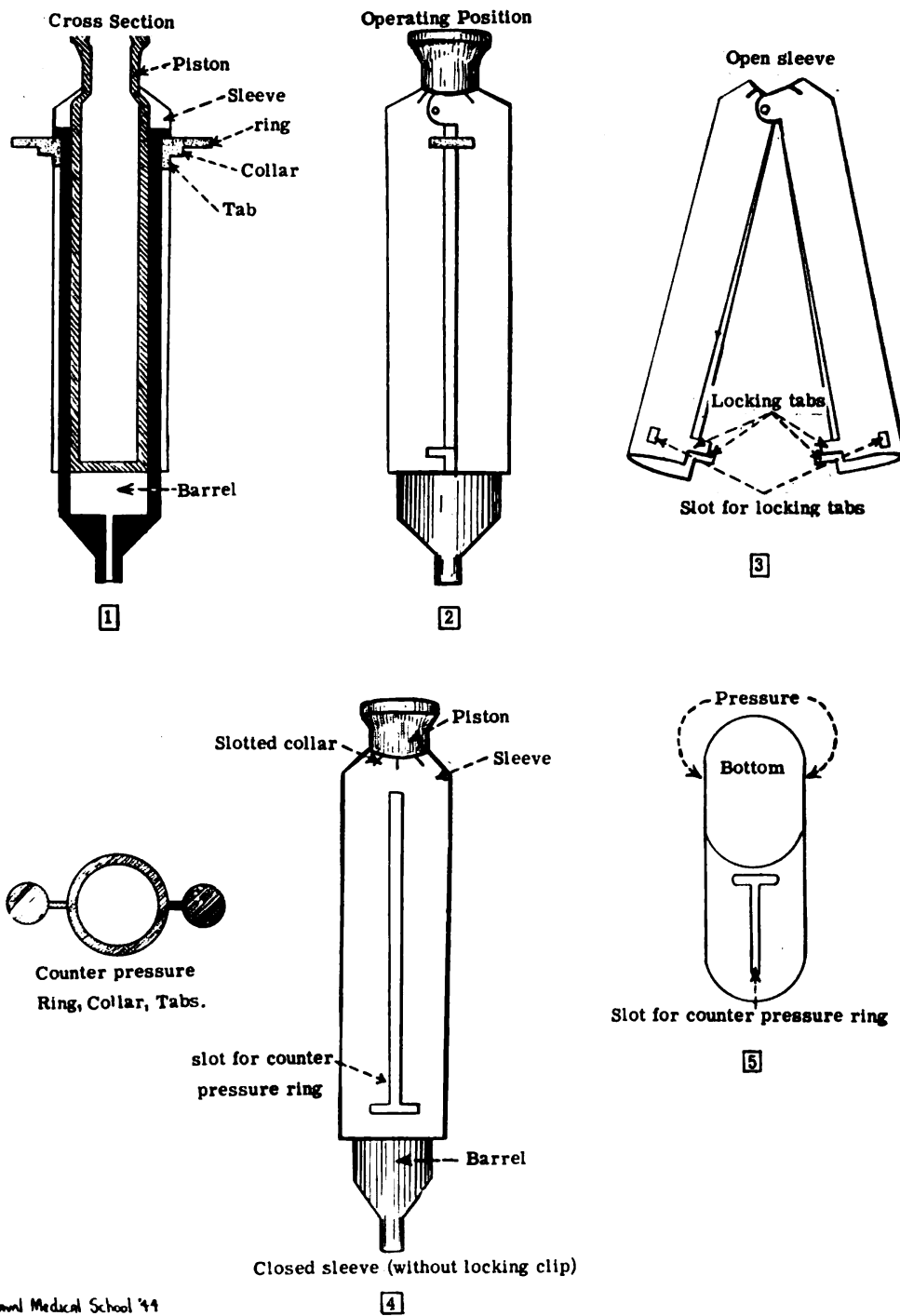
Following the administration of prophylactic vaccines to a large group of recruits at a Naval training station, a number of them developed a low-grade cellulitis at the site of the injection and the area surrounding it. The inflammatory reaction was greater than one would expect from vaccine alone. In an effort to discover the reason for this condition a check was made on the technic of administration of the vaccine and the following observations were made.

When giving inoculations to a large number of men it is necessary that it be done rapidly, and to accomplish this it is the custom to keep a battery of 3 or 4 syringes (10-cc.) loaded with vaccine, and each time an injection is given only the needle is changed. After the syringe has been loaded 2 or 3 times (without sterilizing) the person giving the injection invariably contaminates the surface of the piston and this in turn contaminates the stock solution when he refills the syringe.

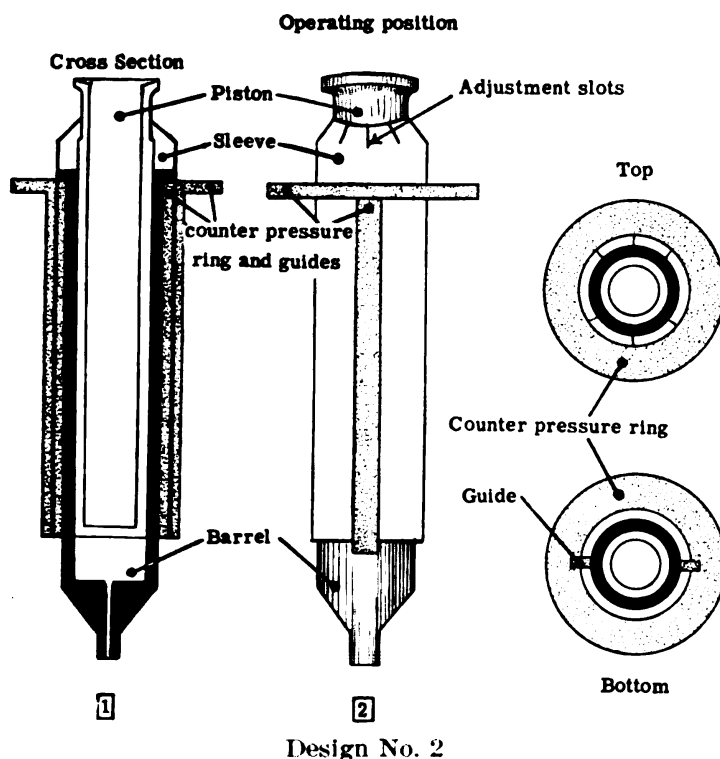
Design number 1.—This is a split sleeve that is attached to the piston of the syringe by means of a rivet hinge and a locking clip which is at the lower end of the sleeve to permit removal and replacement. The purpose of the slot is to permit operation of the sleeve and piston of the syringe as a unit against counter pressure tabs attached to the metal collar or barrel of the syringe. The sleeve is made of a plastic such as celluloid or a similar material.

This sleeve design is made without the locking clip at the base and is applied to the plunger by stretching the slotted collar on the upper end over the piston barrel. When applying the lower end of the sleeve over the tabs on the metal collar, pressure is made on the lower end of the sleeve at about 45° from the slots for the reception of the tabs.

Design number 2.—This is a design for a closed sleeve which necessitates the use of extended counter pressure ring and guide strips as shown in the sketch.



Design No. 1



EFFORT SYNDROME

It is well recognized that some diseases and symptom-complexes which appear to be uncommon during times of peace spring into relative prominence during wars. Many of these are functional nervous disorders resulting from an inability of the individual to adapt himself to his new environment. That some of these syndromes should follow patterns not commonly observed in the civil population and in times of peace is not surprising, for the shift from civil to military duties is both sudden and drastic, producing fears, frustrations, and other emotional reactions in many who up to this time have led tranquil and undisciplined lives; and since the duties of a soldier are in the main physical in nature he will frequently exhibit his dislike for the army or his inability to adapt himself to it by a functional intolerance of effort. The so-called "bent back of soldiers" and the hysterical galts are examples. It is our opinion that "effort syndrome" is another.

The multiplicity of titles which have been applied to this symptom-complex is an indication of the difference of opinion which exists regarding its true nature, and they are all open to criticism from the standpoint of descriptive terminology.—GORDON, K.: Effort syndrome. *Canad. M. A. J.* 50: 362-363, April 1944.

METHODS OF OBTAINING SUCTION IN THE FIELD

SIDNEY L. ARJE

Lieutenant Commander (MC) U. S. N.

and

ROBERT B. VENNER

Lieutenant (MC) U. S. N.

In view of the fact that units in the field are not equipped with means of obtaining suction, two simple devices utilizing materials at hand are submitted. These suction devices are very practicable as to both the proved workability and ease of construction.

CONTINUOUS SUCTION BY MEANS OF ANY GASOLINE VEHICLE

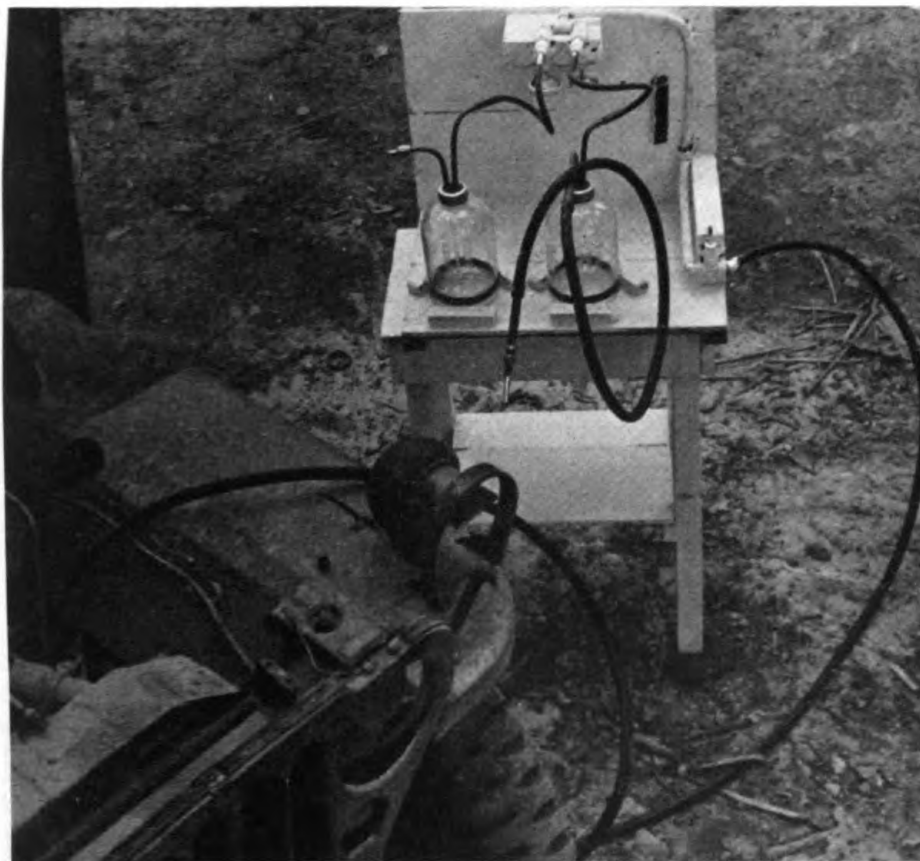
A 12-foot length of rubber tubing sufficiently heavy not to be collapsed easily by strong suction, and of a convenient size to fit over the standard intake valve of the manifold, is run from the vehicle (jeep, ambulance, or truck), into the operating room. This tube is permanently connected to one elbow of the regulating valve fastened onto the side of the wooden frame holding discarded parenteral fluid bottles. The regulating valve is of a standard $\frac{1}{8}$ -inch size and fitted with two elbows.

The amount of suction is regulated by means of a small wrench and when the flow is of desired strength, the wrench is removed from the valve, thus insuring a steady, continuous rate of suction throughout the operative procedure. The speed of the motor has no effect upon the power of suction.

A short length of the same tubing is fitted to the other elbow of the regulating valve and brought up on the frame to a T-shaped metal connection, fitted into two $\frac{1}{4}$ -inch globe valves to one of the right-angled metal tubes pierced through the rubber stoppers of the bottles. When in operation, one globe valve is completely closed, thus using only one bottle at a time. The second can be put into use when the first is being emptied. The second metal tube from within the bottle is fitted with an adapter into which can be screwed the long tubing extending to the patient (fig. 1).

The entire apparatus is left in the operating room on a convenient stand. When its use is anticipated, the tubing is attached to the intake valve of the manifold of the vehicle. After suction has begun

by starting the motor of the vehicle and opening the regulating valve, the globe cut-off valve is opened, and the rate of suction can be visualized by noting the stream of fluid pouring into the bottle. When the bottle is nearly filled, the cut-off valve is closed. The tube extending from the patient to the bottle is disconnected at the latter source and reconnected to the second bottle.



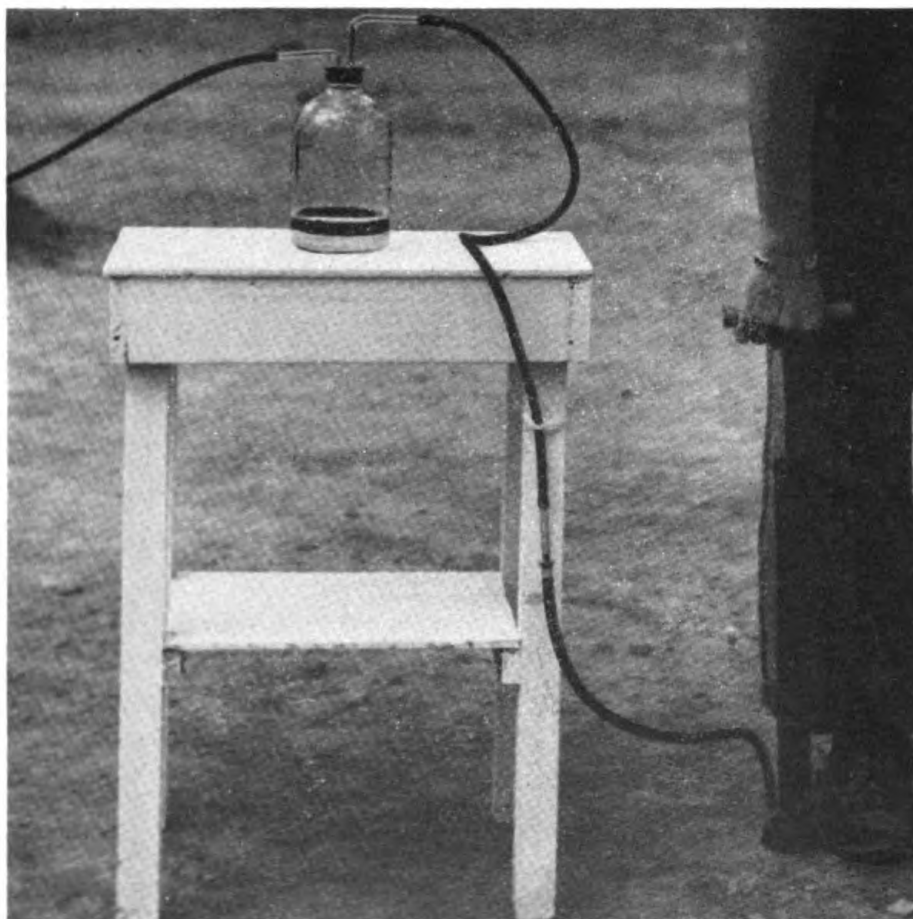
Opened kit showing compartments, and upper shelf removed. A list of poisons

The cut-off valve to the second bottle is opened and the same amount of suction (the regulating valve not touched), has been only momentarily halted. The first bottle can then be emptied and reconnected with no loss of time. Needless to say, it is essential that all connecting parts be fitted with adapters in order that connections be made easily and efficiently. The arrangement of mechanical parts presents no great problem.

The cardinal features of the device are: (1) The utilization of the standard intake valve on the manifold of any vehicle; (2) the convenient, stationary arrangement of suction bottles and hose; and (3) the ease and rapidity with which the entire mechanism can be set into operation.

CONTINUOUS SUCTION BY MEANS OF A HAND PUMP

This method utilizes an ordinary tire pump, which is part of the equipment of all G. I. vehicles. The leather plunger in the pump is inverted. The ball-bearing in the valve at the base of the pump is removed. The connecting tip at the end of the rubber tube of the pump is used by obtaining a tire valve from a discarded inner tube from which the spring valve has been removed. This is screwed into the tip on the end of the tube of the pump and rubber tubing attached to it (fig. 2).



2. Continuous suction by means of a hand pump.

The suction produced by pumping is then utilized by attaching the rubber tubing to a similar discarded parenteral fluid bottle with a 2-holed rubber stopper through which two L-shaped tubes of metal or glass have been passed. The pump is attached to one tube and the suction tip to the other. The latter can be of any desired length and suitable connections made so that sterilization of the terminal section is possible.

For convenience another bottle, similarly equipped, should be ready. When the first bottle used is full, it can then be substituted by the other and emptied, thereby causing only a momentary lapse in the continuity of the suction.

The cardinal features of this device are: (1) The utilization of a tire pump to produce suction; (2) the manual operation of the device making the source of power always immediately available; (3) the extreme simplicity and foolproof character of the device.

SUMMARY

1. Two methods of obtaining suction in the field have been described.
2. Certain features to be noted are:
 - a. The availability of all materials used in construction.
 - b. The measurement and visualization of the force and amount of suction and the nature of fluid removed.
 - c. The efficiency of connecting parts.
 - d. The need of no great skill in either construction or operation.
3. These devices find their greatest use in abdominal surgery. A sterilized tube and tip are connected for intra-abdominal suction. A second tube and tip are available on the anesthetist's table for use during inhalation anesthesia.



SKIN TEMPERATURES

The skin temperature of people in a thermally comfortable environment is normally 32° to 35° C. on the upper parts of the legs and arms, and falls as the extremities are approached, where it is often no higher than the environmental temperature, particularly at the toes. The skin temperature of the extremities decreases when the extremity is raised and increases when the extremity is lowered.

The skin temperatures of six patients suffering from shock were taken and found to vary exceedingly, had no correlation with the degree of shock, and depended on the temperature of the environment.

On the other hand in 19 patients admitted to the hospital in shock the average rectal temperature was 99.3° F. and the average oral temperature was 96.7° F.

The skin temperatures and oral temperatures however seemed to follow each other; when the skin temperature was low the oral temperature was found to be low, and *vice versa*. It appeared therefore that in cases of shock the mouth temperature gives no real indication of the internal body temperature.—WRIGHT, R. D., and DEVINE, J.: Body temperatures in shock. M. J. Australia 1: 21-27, January 8, 1944.

EMERGENCY POISON KIT

WILLIAM D. STUBENBORD

Lieutenant Commander (MC) U. S. N. R.

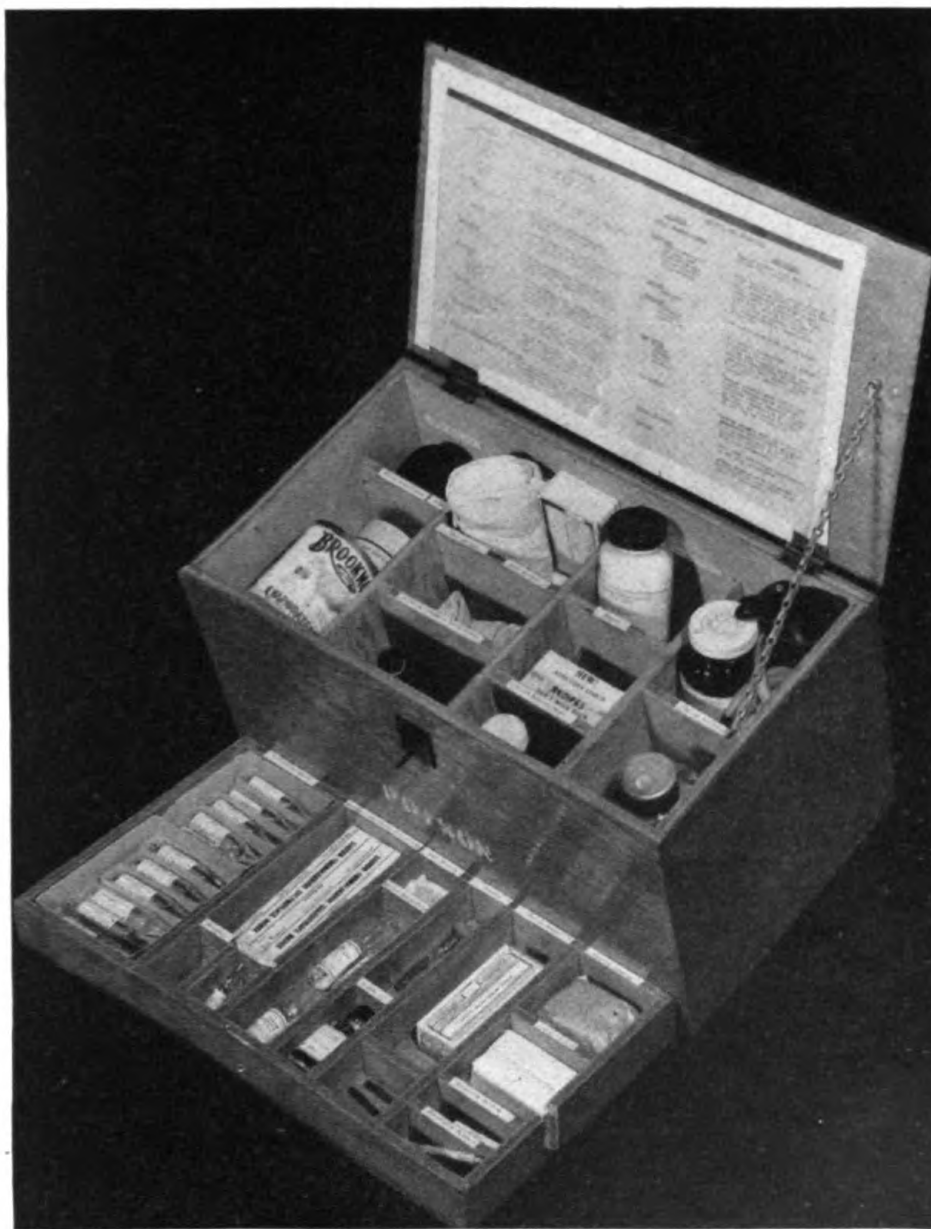
This kit has been designed to meet any emergency in acute poisoning whether on board ship, in a hospital, or at a station. It should be kept in the emergency room and should be immediately available. It should be noted that this kit is primarily for emergency measures and does not in any way take the place of more thorough and comprehensive treatment of poisoning. It is also appreciated that this kit applies only to those poisons most frequently encountered and that there are other antidotes used which may be added at the discretion of the medical officer.

It is suggested that this kit be closed with a seal that can be easily broken, and that its contents be inspected at regular intervals, at which time solutions can be renewed.

The kit is a wooden box $10\frac{1}{4}$ by $10\frac{1}{2}$ by $18\frac{1}{2}$ inches and weighs 26 pounds when filled. It contains compartments below and a removable shelf above, is compact and has space for additional drugs. In view of the fact that milk and eggs are not always available or obtainable, powdered albumen was substituted for eggs and canned milk for fresh milk. A large nail is kept in the box to be used as a can opener. The kit also contains a 1,000-cc. bottle of sterile saline solution, which may be used if water is not available. On the inside of the cover is a list of the common poisons and their antidotes with directions for their use.

The box contains the following antidotes and equipment, all of which may be obtained from the Supply Depot or commissary department:

- 12 ampules 1-cc. redistilled water.
- 1 ampule sodium amytal, $3\frac{3}{4}$ grains.
- 2 ampules 20-grain sodium formaldehyde sulfoxylate.
- 6 ampules amyl nitrite.
- 2 ampules metrazol, $1\frac{1}{2}$ grains.
- 2 ampules caffeine sodium benzoate, $7\frac{1}{2}$ grains.
- 4 ampules sodium thiosulfate, 1 gm.
- 1 ampule ephedrine sulfate, $\frac{3}{4}$ grain.
- 1 ampule containing 20 soluble tablets strychnine sulfate, $\frac{1}{30}$ grain.
- 1 sterile Wassermann needle No. 21.
- 1 sterile hypodermic needle No. 26.



Opened kit showing compartments, and upper shelf removed. A list of poisons and antidotes is pasted on inside of cover.

- 1 sixteen-ounce bottle dilute acetic acid (6 percent).
- 2 cans condensed milk.
- 1 pound sodium bicarbonate.
- 1 package sterile compresses.
- 1 sterile 75-cc. beaker.
- 1 sterile 30-cc. syringe.
- 1 sterile 10-cc. syringe.
- 1 sixteen-ounce bottle solution potassium permanganate 1:3,000.
- 1 two-ounce bottle 95 percent alcohol.
- 1 stomach tube.
- 1 sixteen-ounce bottle dilute ammonia water.

- 1 one-ounce bottle castor oil.
- 1 large nail or can opener.
- 1 one-pound starch.
- 1 bottle of 100 tablets sodium chloride.
- 1 sixteen-ounce bottle of universal antidote composed of:

	<i>Parts</i>
Charcoal	2
Magnesium oxide.....	1
Tanic acid.....	1

- 1 sixteen-ounce magnesium sulfate.
- 1 sixteen-ounce powdered albumen.
- 1 bottle sterile saline solution, 1,000 cc.



TOBACCO SMOKING AND ANESTHESIA

The incidence of bronchitis, atelectasis and bronchopneumonia after abdominal operations and "gas-oxygen-ether" has been studied in 1,257 cases in adults.

The combined figures for all types of abdominal operations show that the morbidity rate for smokers taking more than 10 cigarettes or $\frac{1}{2}$ oz. tobacco a day is about 6 times that for non-smokers. Smokers are more likely to develop complications associated with serious constitutional disturbance.

When abdominal operations are contemplated, it is advisable for smokers to stop or reduce their smoking as a precaution against pulmonary complications.—MORTON, H. J. V.: Tobacco smoking and pulmonary complications after operation. *Lancet* 1: 368-370, March 18, 1944.



ICE AS A LOCAL ANESTHETIC

For home use, or emergencies, or when the area is badly infected and an injection of novocain is unwise, or where ethyl chloride causes too much pain because of its burning sensations, ice is the method of choice for anesthesia.

I have found ice to be useful in the following types of cases:

1. Infected toenails: Keep ice in sterile gauze to a previously sterilized skin for twenty minutes.
2. Carbuncle or boil: Ice works best in these cases; keep ice on area for twenty minutes.
3. Paronychia: Keep ice on for ten minutes.
4. Dislocations of wrists, fingers, and elbow: Keep ice on area with a little pressure, for twenty to thirty minutes.
5. Abscesses anywhere on or near the skin surface: Keep ice on area between fifteen and twenty minutes.
6. Skin growths (nevi and the like): Keep ice on areas for ten minutes and remove growth by knife or cautery.—FRIEDERWITZER, H. H.: Ice as local anesthetic. *M. Rec.* 109: 42-43, January 1944. Abstracted in *Digest of Treatment* 7: 724, April 1944.

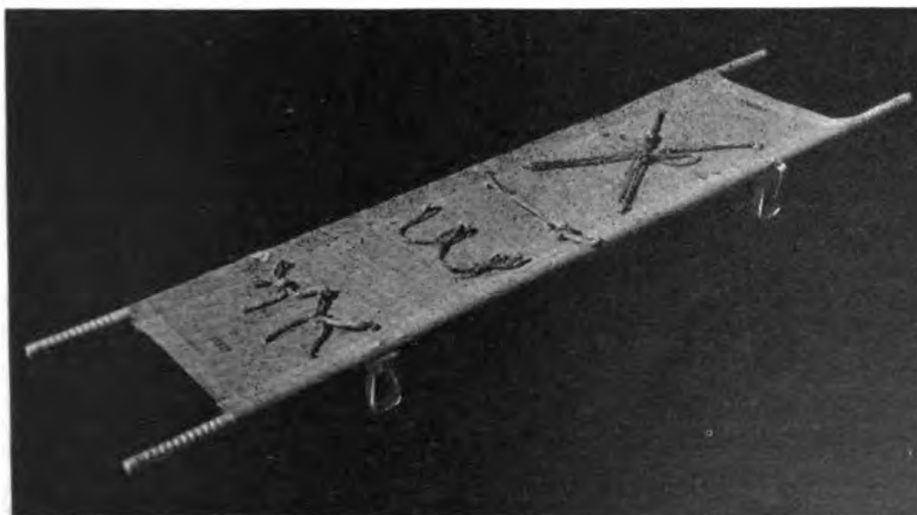
A SIMPLE METHOD OF SECURING PATIENTS TO ARMY-TYPE LITTER

DANIEL J. SULLIVAN

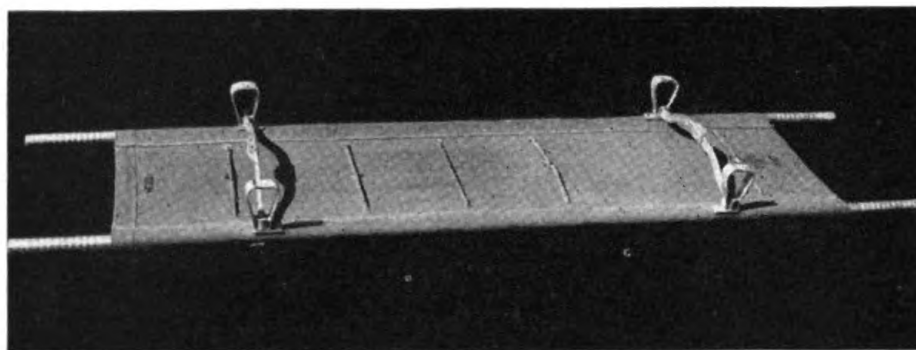
Lieutenant Commander (MC) U. S. N. R.

In organizational planning on this aircraft carrier the canvas stretcher was assigned a limited use, being employed chiefly for transporting patients straight up or down in situations where a hoist might be necessary. It was feared that despite training, the nonmedical personnel used for stretcher bearers might possibly cause severe spinal injury to unconscious patients being transported.

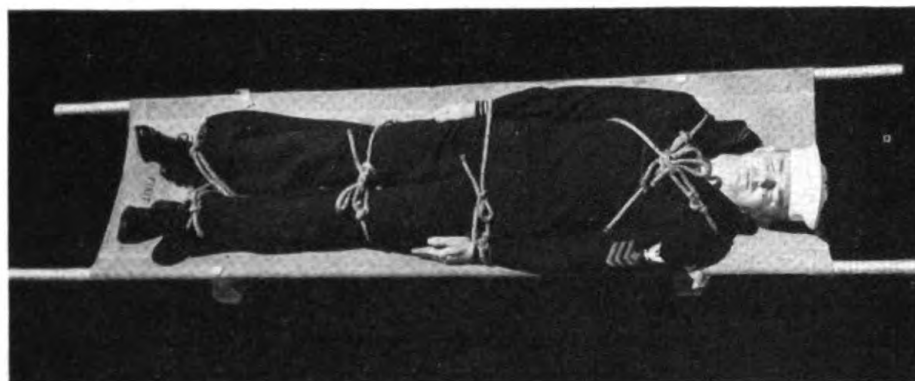
During the organization and training program for the steward's mates and members of the construction and repair divisions who were not actually to be engaged in specific attack or repair duties, and who were to serve as stretcher bearers, it was noted that the Army-type stretcher presented a problem. This stretcher is excellent for carrying a patient along a deck but when obstacles such as narrow passageways, ladders, or small hatches were encountered it was difficult to keep the patient from rolling off. After considering various methods of securing the patient it was decided to attach grommets to the canvas at selected points and pass a line from the front through a grommet at the side, around the back, and out the front through a grommet on the other side. Brass grommets Nos. 2 and 5 were used and ordinary soft, pliable signal halyard was used for line.



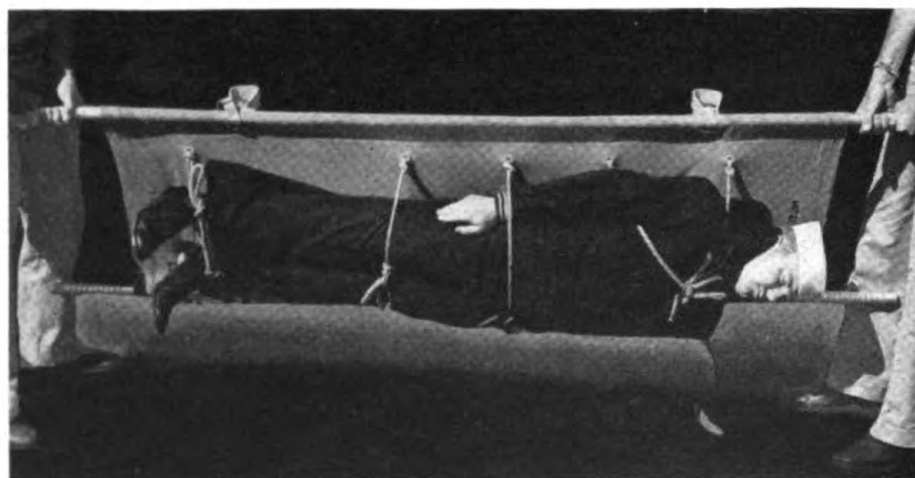
1. Showing grommets and line.



2. Under side of litter.



3. Patient secured in litter.



4. Patient carried sidewise.

Figure 1 shows the litter with grommets and line. Figure 2 shows the back, and figure 3 a patient secured in the litter ready for transportation.

It will be noted that:

1. The patient may be tied as shown in figure 3, or the upper lines may be passed under the axilla if it is desired to carry him feet-first down ladders.

2. The next set of lines cross the pelvis.

3. Both thighs are secured above the knees, and both legs above the ankles.

The patient can thus be made secure for transportation up or down ladders and can be prevented from sliding toward the head or foot of the stretcher.

For going through or making turns in narrow passageways the patient and litter may be turned directly sideways and carried with one pole (fig. 4). If the patient is unconscious the bearer at the head end secures the patient's head.



B-VITAMINS IN RARE AND WELL-DONE BEEF

Right and left 2-rib roasts of beef were cut alike and analyzed, one raw and the other after cooking. The entire meat in each roast was ground and samples used for the determination of thiamine, riboflavin, nicotinic acid and pantothenic acid. The average vitamin contents of the eighteen raw roasts from the commercial carcasses were in $\mu\text{g./gm.}$: thiamine 1.3; riboflavin 1.5; nicotinic acid 49; and pantothenic acid 4.9. Differences in vitamin content between the raw rib roasts within a carcass were not significant for any of the four vitamins but differences between animals were highly significant for thiamine, riboflavin, and nicotinic acid and significant for pantothenic acid. Retentions in rib roasts of beef, rare and well-done, respectively, were: thiamine, 75 and 69%; pantothenic acid, 91 and 75%; riboflavin, 83 and 77%; nicotinic acid, 75 and 79%. Retentions of thiamine and pantothenic acid were significantly lower in the well-done than in the rare roast but with riboflavin and nicotinic acid the differences between rare and well-done were not significant.—COVER, S.; McLAREN, B. A.; and PEARSON, P. B.: Retention of B-vitamins in rare and well-done beef. *J. Nutrition* 27: May 1944.



LASEGUE TEST

With the patient in the recumbent position, the leg is flexed on the thigh and the thigh on the abdomen. The leg is then slowly extended keeping the thigh flexed. The presence of pain in the back or tightness in the hamstrings in any position less than 120 degrees constitutes a positive test. There exists much disagreement in the method of performing the Lasegue test. Some clinics interpret the maneuver described as the straight leg-raising test to be the Lasegue maneuver. However, there is complete accord as to the interpretation and significance of these tests; a positive test is evidence of rootlet irritation.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

PROCESSING X-RAY FILM UNDER TROPICAL CONDITIONS

A. PORTER S. SWEET

Lieutenant Commander (DC) U. S. N. R.

X-ray film consists of a cellulose acetate base, coated on both sides with a special emulsion of gelatin containing a silver halide base, in layers about 0.001 inch thick. After exposure it is subjected to the action of various chemical solutions, a procedure known as processing. X-ray film should be processed if possible only in solutions whose temperatures are between 60° and 75° F. Temperatures below this retard the action of the chemicals. Of greater importance, excessively high temperatures may not only destroy the photographic quality of the radiograph by fogging it, but may also cause "frilling," i. e., soften the emulsion to the extent that it will wash off the base.

Many Naval vessels have x-ray developing tanks that automatically maintain proper solution temperatures, but some are not so equipped. There may also be occasions when dental technicians will be called upon to process x-ray films at tropical shore stations where the temperature of the solution cannot be maintained at or below the safety limit of 75° F. There are a few simple changes in technic which are helpful in processing films at high temperatures.

Only one additional chemical, sodium sulfate (desiccated), is needed, and this is listed in the Supply Catalog. Before proceeding to the tropics a supply of this chemical should be obtained, the amount depending on the quantity of film processing ordinarily done and the expected length of time before additional supplies can be secured.

In table 1 are included directions for adding sodium sulfate (desiccated) to the developing solution, together with other minor but necessary changes in technic.

TABLE 1.—*Technic for x-ray film processing in the tropics*

Temperature F.....	78°-80°	90°	100°	110°
Grams sodium sulfate per gallon of developer.....	200	300	600	800
Developing time (minutes).....	3-4	3	2	1
Time in fixing bath (minutes).....	10	5-10	5-10	5-10
Time in running water (minutes).....	15	15	15	15

When mixing the solution for the acid fixing bath to be used at temperatures higher than 78° F. only one-half the amount of water

recommended in the instructions accompanying the powders should be used.

In tropical processing without a separate hardening bath the film should not be rinsed. It should be taken from the developer and immediately placed in the fixer without rinsing in water, and agitated in the fixer for some time so that the developing solution retained by the film will diffuse in the fixing solution. Because the films are not rinsed, a considerable quantity of developing solution is carried over to the fixing bath; therefore it is important that the fixing bath be renewed much more frequently.

It must be remembered that at 110° F. the developing solution is so saturated with the sodium sulfate that, if the temperature is allowed to drop even 5 or 10 degrees, crystallization will occur, and the original temperature must be restored in order to dissolve the crystals.



TREATMENT OF BARBITURATE POISONING

The clinical course of an acute case of barbiturate poisoning is potentially dangerous, the danger being that either the cardiac or respiratory center, or both, may be so depressed as to bring about cardiac or respiratory collapse. The usual immediate cause of death is respiratory failure.

In mild cases, withdrawal of the drug relieves the symptoms. With severe intoxications, with coma or with impending coma, active and often heroic treatment is required.

The principles of treatment are:

- (1) Removal of the drug from the gastrointestinal tract;
- (2) Counteraction of the depressing effect of the drug on the central nervous system;
- (3) Prevention and treatment of circulatory collapse and its secondary complications.

Active treatment is as follows:

- (1) Insure a patent airway.
- (2) Put the patient in shock position in bed, with the head lowered.

(3) Gastric lavage: This is done routinely even if the patient has been in coma for hours. With nausea there is pyloric spasm and a resulting delay in emptying of the gastric contents. Gastric lavage should be done by inserting a large-sized stomach tube through the nose. There should be three separate washings of the stomach, using 1 quart of warm water for each. After the removal of the residual of the last washing, 2 ounces of magnesium sulfate, or 4 ounces of a 50-percent solution are instilled into the stomach.

Specific treatment consists of giving picrotoxin intravenously. The most convenient way to give this medication is to set up a continuous intravenous drip. There are two reasons for this: first, it is the most effective method of giving the picrotoxin, and, second, it supplies fluids and thus hastens the excretion of the barbiturate

through the kidneys. With a continuous intravenous drip apparatus in use, the picrotoxin solution is injected by a hypodermic syringe into the rubber tubing 6 inches from the intravenous needle. Thus the patient need have but one needle introduced into his vein although he requires numerous and repeated intravenous injections of the picrotoxin. The amount of picrotoxin to be given is directly dependent upon the depth of the coma.

The usual commercial solution of this drug (Picrotoxin-Abbott) contains 3 mg. per cubic centimeter. Usually the picrotoxin is given intravenously at the rate of 1 cc. or 3 mg. per minute until the effects of this stimulus begin to show in the form of tremors of the extremities, twitching of the lips and eyelids and movement of the eyes. The patient will not recover consciousness at this time. As soon as the stage of twitchings has been reached, the dose is decreased in frequency so that the patient is kept at the level of the minimal twitching, for at this level the respiratory and cardiac centers are receiving the maximum stimulating effect of the drug. The respirations become deeper and more rapid and the pulse slower and stronger. Usually it is necessary to give about 1 cc. every 5 minutes to keep a patient at this level. As time progresses and the effects of the barbiturate wear off because of metabolism and excretion of the drug, the dose of picrotoxin is slowly diminished in frequency, being given every 10 minutes and then every 15 minutes. It is discontinued entirely when the patient is sufficiently restless to move about in bed in response to minimal external stimuli.

If an overdose of picrotoxin is given there is a possibility of the development of a clonic or tonic convulsion. While this is rather alarming to the doctor and nurse, it is not serious and can be immediately counteracted by the administration of from 2 to 5 cc. of sodium phenobarbital or other soluble barbiturate intravenously.—DORSEY, J. F.: Picrotoxin treatment of barbiturate poisoning. *J. Nerv. & Ment. Dis.* 99: 367-375, April 1944.



JUGULAR COMPRESSION TEST

With the patient erect, a blood pressure cuff is placed about the neck. The cuff is inflated to 40 mm. Hg. and pressure is maintained for two minutes. The return of venous blood from the head is thus impeded with resulting increased intracranial pressure, and, by transmission, increased intraspinal pressure. This test exaggerates pain if it is radicular in origin. Variation of pressure rather than maintenance of increased pressure causes pain. Hence the patient may also have increased pain with sudden release of the cuff pressure. This test is usually positive in those cases in which pain is also exaggerated with coughing and sneezing. A positive test is said to be pathognomonic of intraspinal disease.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 263-271, April 1944.

EDITORIALS

CAUDAL ANESTHESIA

Considerable literature has accumulated since Edwards and Hingson's¹ memorable paper on continuous caudal anesthesia in obstetrics. As in any intriguing movement a flood of articles sponsoring the use of the method first appeared. The zeal with which the advantages were recounted verged on enthusiasm. Soon however as the series of cases broadened an occasional report of a mishap either in the form of an intoxication, infection, or fatality caused the enthusiast to pause, and spoke a warning of certain potential major hazards inherent in the routine and indiscriminate use of the method.

This apparently American contribution² to obstetric anesthesiology is not new. Caudal anesthesia employing the single injection technic has been used extensively for years in surgical procedure. The high percentage of failures even in expert hands, the time required for administration and the interval lag before the anesthetic takes effect nullified the advantages of this method and led to its discard as an agent of wide application. Moreover Zweifel³ in 1920 used single caudal injections in obstetric cases but not without fatal accidents. Meeker and Bonar⁴ successfully employed sacral nerve block in 1923 and discussed its usefulness in normal deliveries.

In selected instances and under certain conditions caudal single injections achieve ideal analgesia. Unfortunately its usefulness as a therapeutic agent is not generally appreciated. In intractable pain from rectal or associated malignancies its use can be advantageously employed, as also in cases of sciatic nerve involvement.

Lemmon's⁵ proposal in 1941, however, of continuous spinal anesthesia, suggested to Edwards and Hingson the caudal route for the introduction of fractional doses of an anesthetic substance in the relief of pain during childbirth.

¹ EDWARDS, W. B., and HINGSON, R. A.: Continuous caudal anesthesia in obstetrics. *Am. J. Surg.* 57: 459-464, September 1942.

² KOSNAK, G. W.: Discussion of some observations in use of continuous caudal analgesia, by LULL, C. B. *Am. J. Obst. & Gynec.* 47: 323, March 1944.

³ ZWEIFEL, E.: Fatalities after sacral anesthesia. *Zentralbl. f. Gynäk.* 44: 140, February 7, 1920.

⁴ MEEKER, W. R., and BONAR, B. E.: Value of sacral nerve block anesthesia in obstetrics. *J. A. M. A.* 81: 1079-1083, September 29, 1923.

⁵ LEMMON, W. T., and PASCHAL, G. W., Jr.: Continuous spinal anesthesia, with observations on first five hundred cases. *Pennsylvania M. J.* 44: 975-981, May 1941.

Since 1942 continuous caudal anesthesia has been almost entirely restricted to the parturient patient and sufficient data has accumulated in the literature to permit an evaluation of the method's real worth at this time.

From a thorough analysis of the many contributions in the field, it appears clear that there is a definite place in obstetrics for this form of anesthesia. It is equally as positive however that the method has a restricted usefulness. It is not for routine use and its demands for constant attendance makes it impractical except in institutions especially equipped with the required assistants and facilities.

On the other hand considerable stress has been placed on the many highly dangerous complications. To those familiar with the technic, this caution has approached overemphasis. Even as in other forms of anesthesia the method has admitted contraindications which it would be foolhardy to disregard. Excluding these conditions the sequelae become accidents mostly of faulty administration.

Hedged in by the many restrictions, shortcomings, and inherent demands it imposes, it is not likely that continuous caudal anesthesia will be any more generally adopted than is the single injection method. This is regrettable as in those instances where indicated and where effective function can be anticipated, and as discussed by Russell and Conley in this *BULLETIN*, p. 100, either caudal anesthetic method is an extremely desirable and worth-while agent.

SURGEON OR INJECTIONIST

For years the pendulum of treatment for cystic disease processes has oscillated between the knife and the needle. The cause of this oscillation, whether through unhappy surgical end-results, the claims of success without surgery, or the impetus through proprietary promotion is speculative. The suggestion of surgery to most people is countered by a request for reflection and decision.

Injection of foreign material into pathologic cavities has a long history. Not many years ago the finding of paraffin in hernial areas was relatively common. Hydroceles and various cysts have long been subjected to sclerosing agents.

The poor permanent results in the injection treatment of hernia and the recurrence of hemorrhoids after injection, necessitating ultimate resort to surgery for relief, have restricted this form of therapy to a narrow field. The serious sequelae often following hydrocele injection have outweighed any advantages that may be obtained from this therapeutic method.

It is perhaps the prevalence of varicose veins, the mutilating disfigurement of their surgical extirpation and the poor esthetic end-

results that demanded an approach other than surgical for this condition and gave impetus to the injection form of treatment.

With the discovery of relatively harmless sclerosing agents, injection therapy became world-wide. Rapidly other pathologic processes were attacked. Hemorrhoids, hernias, varicoceles, pilonidal sinuses, fistulas, bursae and other similar disorders were subjected to this therapy. It appeared as though surgeons had forsaken the knife for the needle and had become confirmed injectionists.

That the injection treatment of varicose veins has suffered from an unbiased evaluation of its worth is affirmed by the return to the practice of saphenous vein ligation. The number of failures to cure by sclerosing agents is shown by the number of rejections of service personnel for varicose veins.

Obliteration of a dilated venous channel is not a simple procedure. Any surgeon familiar with blood vascular surgery understands the complexity of vessel anastomoses and has been chagrined at the apparently stubborn and permanent character of venous sinuses. Experience has taught that saphenous ligation necessitates thorough dissection and excision of the 7 to 10 communicating branches about the fossa ovalis. As an added assurance, some have resorted to retrograde instillation of sclerosing material into the distal portion of the excised saphenous vein, but the hazards of this procedure offset any anticipated good from the method.

Hanschell's report¹ of the results obtained in over 700 varicose vein cases bids well for a return to a strictly surgical approach to this perplexing problem. After the recommended ligation and excision in the region of the fossa ovalis, multiple divisions along the entire course of the saphenous vein are done in carefully chosen sites. The skin incisions are usually one-third inch in length and seldom require suturing. It is stated that these tiny venesections often make ligatures unnecessary.

The cosmetic and curative results call for a more general trial of this method. Vein obliteration by sclerosing substances depends upon establishing a phlebitis and periphlebitis of sufficient proportion to cause thrombosis-necrosis of the vasa vasorum, destroying the nutrient artery and involving a complete cross section of the vein. Sclerosis fibrosis occurs only when the continuity of the vein is interrupted by a circumferential necrosis of its wall. As Hanschell observes, sclerosing injection is necrosing injection; its success depends on doing an unpredictable and uncontrollable necrosis. What the surgeon does with a scalpel is sure, controllable, and predictable; it involves much less danger and pain.

¹ HANSCHELL, H. M.: Hazards in treatment of varicose veins. *Lancet* 1: 421, March 25, 1944.

DYE DELINEATION OF SINUS TRACTS

It is generally agreed that complete excision of a sinus tract is the only assurance against recurrence. Uprooting the many minute arborizations, however careful the dissection, is a difficult, tedious and often an unsuccessful procedure. Many surgeons nevertheless are adverse to delineation of the tract by instillation of contrast media, contending that such a method creates artifacts. It is thought that alcoholic solution will dialyze through the lining membrane and smudge the adjacent tissues, whereas aqueous solvents require pressure to force the coloring fluid to any distance along the tract. Force sufficient to cause penetration of the minute anastomoses distends the walls and permits escape of the dyeing agent. In either instance the delineating purpose is defeated and often a new obscuring problem is created.

Fistulous surgery is meticulous surgery, and everyone undertaking the eradication of sinus tracts assumes a special responsibility to the patient. To do the best of one's ability is not enough when a patient is forced to undergo two or three operations because of the surgical failure to exploit every means available for the complete excision of the pathologic process. This argument becomes particularly forceful in the face of the aphorism that complete excision is the only assurance against recurrence of sinus formation.

The controversy is packed with too much import from the patient's viewpoint to permit the issue to remain controversial. The prevalence of pilonidal cyst in the services and the many surgical proposals for its permanent cure attest to the difficulties involved if recurrence is to be reduced substantially.

The recent proposal of the instillation of methylene-blue-hydrogen peroxide solution appears to obviate the principal objections to the delineation procedure.

The efficiency of the method depends upon the chemical release of oxygen which distends the lumen of the tract and projects the dye into every communicating branch. Extravasation and pressure are controlled by permitting the ebullition of the gas mixture at the injection orifice.

The method seems sound and is worthy of a more general application.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

CLINICAL TROPICAL MEDICINE, by 27 authors, edited by Z. Taylor Bercovitz, M. D., Ph. D., F. A. C. P., Assistant Clinical Professor, New York Post-Graduate Medical School, Columbia University; with a foreword by Wilbur A. Sawyer, M. D., Director, International Health Division, Rockefeller Foundation. 957 pages; illustrated. Paul B. Hoeber, Inc., New York, publishers, 1944. Price \$14.

This book is $10\frac{3}{8}$ by $7\frac{1}{2}$ by $1\frac{3}{4}$ inches and weighs well over 5 pounds. Held in one's hands it quickly causes the arms to tire and for comfort must be supported on a table or some type of dictionary holder. However this criticism of its burdensomeness is subordinate.

In these times of priority and scarcity it does seem that the wide margins and blank spaces use up an extravagant amount of paper. A first impression is one of a *deluxe* edition intended for limited distribution.

In this era of encyclopedic knowledge it seems advisable to have each subject discussed by an authority, and the editor is to be congratulated on his selection of collaborators.

About forty years ago I got a copy of Volume II of Allbutt and Rolleston's System of Medicine, second edition. In that volume, dealing exclusively with tropical diseases, each subject was prepared by a master. You have but to read the list of contributors to become familiar with the names of the pioneers of tropical medicine at the turn of the century.

In the book under review, the chapter on yellow fever has been written by an authority who is still active in research—not a desk man. Doctor Soper has given us a concise and thorough presentation of the latest developments in this scourge of peace and war. The last chapter on yellow fever has not as yet been written, and Manson's hypothesis about the spread of yellow fever to the Orient still holds. On page

402, referring to the Councilman bodies, I feel that many readers will fail to grasp the tremendous significance of these bodies in a microscopic study of a section of yellow fever liver.

One of the pioneers in research on vitamins has been chosen to write the chapters on the deficiency diseases. I think Vedder's introductory chapter on nutritional diseases is a very lucid, scientific presentation of the nature and application to medicine of the vitamins. As would be expected of one who has participated in the research on beriberi, the chapter on this disease is to be highly praised.

Considering the extreme importance of snake poisoning among American soldiers in India and Australia, James A. Oliver's discussion of the subject is scientific and timely. I do feel, however, that the excellent chapter on management of snake bite by Dudley Jackson could have been incorporated in the preceding chapter of Oliver's. Multiplying chapters certainly means multiplying blank spaces.

Until Professor Dodge gave us his "Medical Mycology," 1935, we had to go to foreign sources for authority as to nomenclature and classification. In his three very practical and scientific chapters on the mycoses, Morris Moore, of Washington University, has followed in the footsteps of Dodge, both Dodge and Moore being recognized as authorities in this field. I am constrained to compare the discussion of the mycologist, Morris Moore, on moniliasis with that of Castellani with his 40 species, differentiated chiefly by fermentation reactions.

While typhoid fever is of extreme importance in the tropics it is usually excluded from the group of diseases classified as exotic or tropical. Should we include typhoid fever, we should certainly include tuberculosis—the great scourge for natives of the tropics.

At any rate a discussion of the differences between the typhoid fever as encountered in the tropics and that seen at home is worthwhile. In the "Memoranda on Medical Diseases in Tropical and Subtropical Areas," issued by the British War Office, November 30, 1942 (7th edition), will be found a splendid discussion of the variations in typhoid fever of the tropics and that observed in Europe. This little book (pocket size) was first written by the late Sir Andrew Balfour, one of the great men of tropical medicine, to meet the needs of medical officers during World War I. It is extremely practical and has been a favorite with me for many years, as showing the possibilities of condensation.

Again referring to the apparent disregard for utilization of space, I note the chapters on Giardiasis and Balantidiasis, the parasites of which are discussed rather fully under "Intestinal Protozoa."

Furthermore, the insertion of the excellent illustrations by Dobell and O'Connor, pages 36 to 64, would seem to be giving an undue weight

to protozoology and thereby increasing the blank spaces so conspicuous in this volume.

A MANUAL OF MEDICAL PARASITOLOGY, by *Clay G. Huff*, *Professor of Parasitology, University of Chicago*. 88 pages. The University of Chicago Press, Chicago, Ill., publishers, 1943. Price \$1.50.

With the advent of global war parasitology has assumed a prominence in medical teaching never before enjoyed. A manual on parasitology is not only timely but definitely advantageous to medical students and technicians in diagnostic laboratories. Succinct in character this small volume of less than 90 pages is surprisingly comprehensive. Intestinal, liver, and lung flukes, the various types of roundworms, intestinal protozoa, flagellates, and insect vectors constitute some of the subjects treated. The final chapter on the method of procuring an examination of specimens is decidedly well written.

In so far as the book was primarily intended as a practical guide to teaching parasitology, a blank page for note taking, in the opinion of the reviewer, would have materially improved the practical aspect of the work.

WHITE BLOOD CELL DIFFERENTIAL TABLES, by *Theodore R. Waugh*, *B. A., M. D., C. M., Pathologist-in-Chief, Royal Victoria Hospital; Associate Professor of Pathology, McGill University*. 128 pages. D. Appleton-Century Co., Inc., New York, publishers, 1943. Price \$1.60.

The author presents a set of multiplication tables for computing rapidly the actual number per cubic millimeter of each type of white blood cell based on the differential percentages. These tables cover a range from 10 cells per cubic millimeter to 10,000.

Since many hematologists feel that the finer diagnostic value of the differential resides in the actual number of white cells of each type as compared to its normal, rather than in the percent figure or relative value, this new book will afford laboratory workers a time-saving factor in their work.

This publication of these special tables in book form will be welcomed by busy laboratory workers, pathologists, and clinicians.

THE WOUNDED GET BACK, by *Albert Q. Maisel*; with a foreword by *Ross T' McIntire*, *Rear Admiral, Medical Corps, U. S. N., The Surgeon General of the Navy*. 230 pages. Harcourt, Brace and Co., New York, publishers, 1944. Price \$2.50.

The Navy wounded get back because of the ministrations of a most efficiently organized and highly alert Medical Corps, because of modern advances in medicine and doctors waiting zealously at front lines to care for the wounded, or at South Pacific bases that have been cleared by advance patrols of the Malaria Control Commission and readied with hospitals made of Quonset huts; they get back, too, because of efficiency in evacuating casualties and because of the heroic efforts of all who aid in this work. This is what the general public has wanted

most to know, just how the wounded and sick are cared for and evacuated. To answer this question, Maisel, a correspondent, traveled on hospital ships, visited base and mobile hospitals in the South Pacific, flew with the wounded to evacuation centers, and brought back the story from a layman's point of view for laymen.

He traveled on the *Solace* and the *Relief* and reports a well rounded experience in naval medical activities afloat and ashore, told in well written, very readable narrative style enlivened with intimate sketches of many of the medical personnel. From a medical point of view the emphasis may sometimes be imbalanced; possibly the hospital corpsmen do not get the full credit they deserve, and occasional exception to his opinions will be taken by the medical reader. But on the whole the book should prove very interesting to every medical officer for the bird's-eye view it gives of the actual workings of every phase of Naval medical activity, the salient, intimate details of life on a hospital ship and at advance bases. In every work such as this there is a problem of what to include and what to omit in order to paint a good picture of the whole in a few hours' reading time; there is also the problem of holding interest to the end. Mr. Maisel has done his job well.

WHAT IS HYPNOSIS, *Studies in Auto and Hetero Conditioning*, by Andrew Salter. 88 pages. Richard R. Smith, New York, publishers, 1944. Price \$2.

This volume by Salter, a psychologist, has had much attention from the lay press. The opening chapters discuss the subject "What Is Hypnosis," and give some preliminary experiments in autohypnosis. The appendix contains a discussion of "Three Techniques in Autohypnosis," which article was published by the author in the *Journal of General Psychology* in 1941. Salter disagrees with most other hypnotists and denies that hypnosis is a phenomenon of suggestion. He believes it is the most scientific segment of psychology and states, "It is based on associative reflexes that use words as triggers of automatic reactions. Hypnosis is the production of reactions in the human organism through the use of verbal or other associative reflexes." He recalls that Pavlov and Bechterew alluded to conditioned reflex approach to hypnosis. Among other things Pavlov stated, according to Salter, "We can, therefore, regard suggestion as the most simple form of a typical reflex in man."

Salter denies that a trance state is necessary in hypnotism and he recalls the work of Hudgins, whom, the author notes was able to condition subjects to contract their own pupils. This was done by first using a light and a bell as a stimulus, then the light was removed and finally the bell, and the subjects were able to contract their pupils when they thought of the word "contract." Salter believes that the complicated phenomena of posthypnotic suggestion reduce themselves

to nothing but a series of conditioned speech and body muscle acts. He agrees with Tuckey that the better the intelligence, generally speaking, the better the subject if he can be hypnotized at all. He attempts to show that the "mental alienation" concept of the Kenny treatment of infantile paralysis has a striking parallelism to hypnosis, although this is denied by Sister Kenny.

The book and the work of the author suffer somewhat by the aura of melodrama which has been attached to them. In explaining his concept of autohypnosis, he states that it "makes no difference whether the suggestions come from within or without." One of his examples concerns a subject who, to win a bet, was able to anesthetize his hand so that a burn from a cigarette caused no pain. It is this type of action, plus the author's comments on the production of positive or negative visual or auditory hallucinations, that will make the physician look askance upon the author's approach to the problem.

ALLERGY, ANAPHYLAXIS AND IMMUNOTHERAPY, Basic Principles and Practice, by *Bret Ratner, M. D., Clinical Professor of Pediatrics, New York University College of Medicine*. 834 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$8.50.

This volume relates to a field of medicine that is becoming increasingly important to general practitioners. The materials used in the diagnosis and treatment of the allergic state are defined. There is an explanation of the pathologic processes occurring in allergy with a description of the newer methods of diagnosis. The explanation of the mechanism of allergy is related to the use of biologicals in the prevention and treatment of infectious diseases. Illustrations covering experimental and clinical subjects are well chosen. There is an interesting section on the nature of and reaction to sulfonamides and a comprehensive bibliography on allergy.

This book should be helpful to physicians in many fields of practice as an introduction to the newer methods developed in the field of allergy.

THE MODERN MANAGEMENT OF COLITIS, by *J. Arnold Bargen, M. D., M. S., F. A. C. P., Chief of the Section on Intestinal Diseases, Division of Medicine, Mayo Clinic*. 322 pages; 148 figures. Charles C Thomas, Springfield, Ill., publishers, 1943. Price \$7.

The classification of ulcerative colitis into 9 separate types, one of Dr. Bargen's important contributions to gastro-enterology, has served a most useful purpose in the understanding and management of this disease. Each of these types is accurately described in this book and illustrated by carefully chosen radiographs and case histories. In addition, the irritable colon syndrome deservedly enjoys a section all its own and the volume is completed by a chapter devoted to "Conditions to be Distinguished from Colitis."

A careful perusal of this treatise cannot help but add to one's understanding of the origin, nature and treatment of functional and organic derangements of the colon. The text is generously illustrated with radiographs and photographs of specimens and tissue sections. The format, printing and binding combine with the well-written text to make a volume worth the time and attention of every internist.

MEDICAL RADIOGRAPHIC TECHNIC, prepared by the *Technical Service Department of General Electric X-Ray Corporation*, under the editorial supervision of *Glenn W. Files, Director*; in association with 17 contributors. 365 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1943. Price \$6.

The authors have attempted to produce a book designed for the training of student technicians. They have used many excellent diagrams, composite photographs and copies of radiographs. As a student text it is better illustrated and presented in a more understandable language for the technician than the usual text of this type.

A large portion of the book is devoted to fundamental electrical concepts, basic generating circuits and the many factors that affect the quality of the radiograph. Brief concepts of stereoscopy, planigraphy, foreign body localization, fluoroscopy, soft tissue radiography and anatomy are presented. However, the chapter on positioning and technic is brief and presents only the usual positions encountered in routine work in a general laboratory.

This book is too elementary to be recommended as a reference text for physicians.

LINCOLN-DOUGLAS, THE WEATHER AS DESTINY, by *William F. Petersen*; illustrated by *Jean McConnell*. 211 pages. Charles C Thomas, Springfield, Ill., publishers, 1943. Price \$3.

Petersen the ecologist and Petersen the writer have merged in this volume to produce an entertaining and provocative story of three people, Lincoln, Douglas and Mary Todd, who in the manner of Dr. Faustus, are chosen merely as representatives of mankind. Lincoln was selected because, though a Promethean, he was still controlled by his environment, and even the giants, contends Dr. Petersen, cannot rise above their destiny—the courses prescribed for them by nature's laws. What they are, what they think, and what they do is conditioned wholly by the weather, by the sun and the moon and the stars, the wind and the rain and the temperature.

Hippocrates wrote on aeration of the tissues in the etiology of diseases and first mentioned the influence of the season in which conception takes place as an influential factor in the life of the individual. The Greeks, says Petersen, had a true perspective of mankind; this perspective has been shrinking since the Middle Ages and modern scientists concentrate on the individual, the cell, molecule, ion and nucleus of the ion.

However bizarre this work may seem, the relationship of man to his environment is not so much a moot question as it is an unknown quantity. That credence may be given this point of view is evidenced by the respectful attention accorded it by the medical profession. The book is beautifully printed, bound, and illustrated with extremely attractive woodcuts in the manner of Grant Wood by Jean McConnell, and by numerous meteorograms in the appendix showing the state of the weather at various major and minor crises in Lincoln's life.

THE HOSPITAL IN MODERN SOCIETY, by 98 contributors, edited by *Arthur C. Bachmeyer, M. D., Director, University of Chicago Clinics*; and *Gerhard Hartman, Ph. D., Director, Newton Hospital, Newton Lower Falls, Mass.* 768 pages. The Commonwealth Fund, New York, publishers, 1943. Price \$5.

This volume consists of a collection of articles selected from the literature in the hospital field and in the allied fields of medicine, public health, hospital management, law, sociology, and psychology.

In justification of such an anthology, the editors state that, "It represents an endeavor to assemble material that is so widely dispersed in the literature as to be unavailable to the average individual who is interested in hospital administration and to arrange that material in an orderly manner.

"Each article was chosen for its judicious analysis of a problem and because it stimulated thought on that problem regardless of the view of the editors and at times in contradiction to opinions expressed in other articles.

"Among the authors are men and women who may be numbered among the deans of hospital administration as well as the younger generations in the field. Ninety-eight authors are represented by the 145 articles."

There are 29 chapters in the volume, covering such topics as: Historical review, hospital service, the trustee, hospital organization and management, the hospital administrator, medical staff organization and relationships, nursing education and nursing service, operating room, obstetrical service, x-ray service, out-patient department, special services, medical social service, clinical and pathological laboratories, pharmacy, medical records, admitting and discharge, financial control, legal aspects, hospital construction, plant maintenance, purchasing, food service, housekeeping, laundry management and linen control, personnel relations, public relations, group hospital and health insurance, and public health.

A list of "References for Further Reading" is appended to each chapter for students who wish to pursue a special subject further.

The volume will doubtless be of value to students and administrators of civilian hospitals; its value to personnel in the Medical Department of the Navy is negligible.



METABOLIC EFFECTS OF THIOURACIL IN EXOPHTHALMIC GOITER

Early in 1943 a new type of therapy for Graves' disease was introduced. This was based on the goitrogenic effects of sulfonamides and certain derivatives of thiourea as demonstrated in animals.

The mode of action of these drugs appears to be an interference with the enzymatic synthesis of thyroid hormone. The exact point of block is still not known, but it is definitely established that the thyroid gland is rendered incapable of utilizing iodine for this process. The resultant thyroid insufficiency leads, via anterior pituitary stimulation, to an ineffectual hyperplasia of the thyroid acinar cells. The peripheral action of administered thyroid hormone, however, remains unimpaired.

Clinical reports to date on the use of thiouracil (and to a lesser extent, thiourea) in Graves' disease have shown that there is a decrease in the basal metabolic rate and in the protein-bound iodine of plasma, an increase in serum cholesterol and body weight and a disappearance of the symptoms of Graves' disease. No improvement in exophthalmos has been noted; and the effect on the size of the gland has been variable. Toxic reactions have been few, the most notable being a non-fatal agranulocytosis.

Effects of thiouracil on the disturbances of calcium, phosphorus, nitrogen and creatine metabolism occurring in Graves' disease moreover are comparable to the beneficial results following successful subtotal thyroidectomy or iodine remission. These findings indicate the physiological nature of the remission produced by this new chemotherapeutic agent.—SLOAN, M. H., and SHORE, E.: Metabolic effects of thiouracil in Graves' disease. *Science* 99: 305-307, April 14, 1944.



SEDATION IN HEAD INJURIES

The use of codein in combination with nembutal is recommended for the restlessness due to cerebral injury after secondary disturbing factors have been eliminated. Codein and nembutal are effective and least harmful, based upon a study of the cerebrospinal fluid pressure, pulse, respirations, blood pressure, and motor activity. Their use, however, should be discontinued as soon as possible and their routine use is condemned. The use of morphine should be avoided except when it becomes imperative for relief from pain.—GURDJIAN, E. S., and WEBSTER, J. E.: Sedation in patients with acute head injury. *Am. J. Surg.* 63: 236-239, February 1944.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

MEDICAL DEPARTMENT OF A LABOR BOARD

NEWTON T. SAXL

Commander (MC) U. S. N. R.

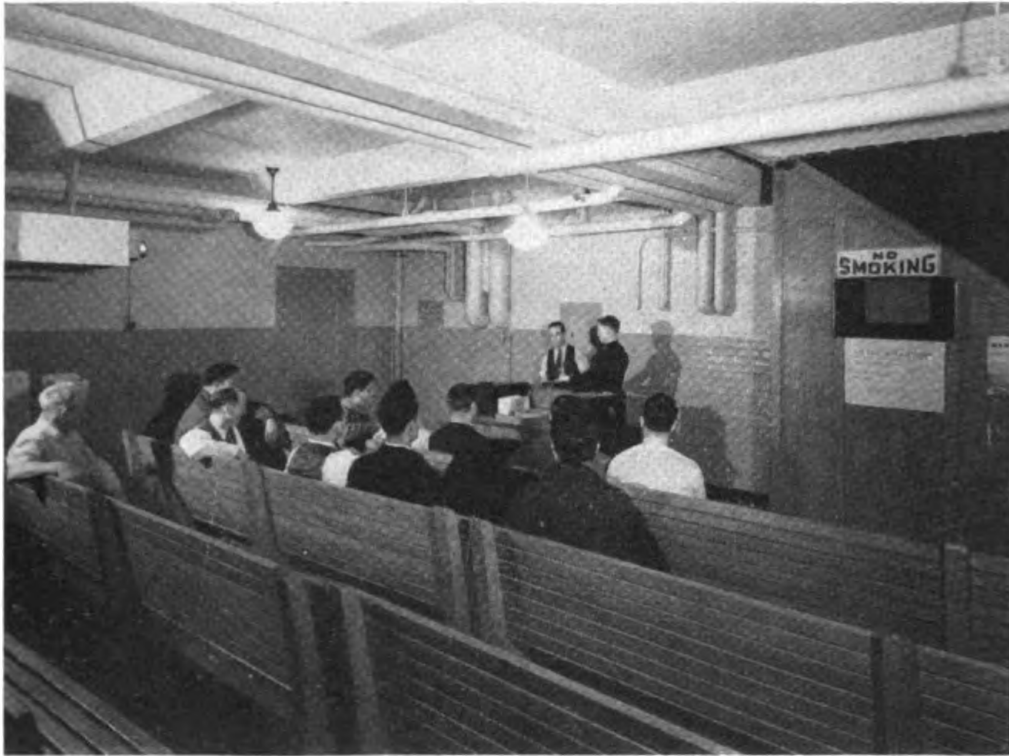
Offhand a medical officer of the Navy, on glancing at the title of this paper, may wonder what it has to do with him. Seemingly work on a Labor Board does not have to do with what he had been led to believe would be his duties when he became part of the Medical Department of the Navy. However civilian labor builds and maintains the ships of the Navy; installs, repairs, and keeps in order most units of shore installations; manufactures and repairs precision instruments, and so forth; and thereby makes the Navy's existence possible. The health of the workers is in the hands of the Navy Medical Department and therefore the medical branch of a Labor Board is an integral factor in keeping the Navy efficient and afloat.

A Labor Board is composed of a senior member who is a line officer with rank not lower than lieutenant commander where possible; a medical officer in charge of and representing the Medical Department; several civilian employees; and one civilian recorder.

The Medical Department is composed of the medical officer in charge, assistant medical officers, nurse, corpsmen and WAVES. Certain specialties such as neuropsychiatry, surgery, gynecology, eye, ear, nose and throat and cardiology should be represented when possible.

In large plants, particularly during war, where the volume of employment and nonindustrial illness is necessarily great, the physical setup for rapidity of examination assumes primary magnitude. The efficiency of the unit depends upon the smooth running of the organization and this may only be accomplished when there is adequate room to work. An ideal arrangement is based on the production line principle where an applicant moves forward from one examination to the next without back-tracking. This avoids confusion and so saves time.

In this Navy Yard we have tried to accomplish this, and with very minor drawbacks have succeeded. In the waiting room there is a continuous film being shown, under the auspices of the safety engineer, which stresses the avoidance of accidents by ordinary care. This gainfully occupies the attention of the applicants until ready for examination. It has been found that 15 is the ideal number to examine at one time.



1. Male waiting room, showing fingerprint corner and motion picture.

From the waiting room the applicants move to the eye and ear room, where their vision and hearing are checked. This room is slightly over 20 feet long. From there they advance to another room, where the height and weight of each are recorded, and blood withdrawn for a Wassermann test.

Progressing, they enter a lavatory, where they find empty bottles and labels awaiting them. Having passed a urine specimen they hand it through a window to the laboratory and proceed to the final room, where they strip for physical examination.

Following physical examination, the applicants dress to the waist and enter a waiting room from which they are called one at a time for a chest x-ray which is taken with a microphoto-fluoroscopic 35-mm. machine. Any suspicious cases are checked by a large chest plate.

Since a Labor Board is also concerned with the nonindustrial illnesses of the workers, there must be provision made to examine those who have been ill or injured and desire to return to work, and those

who are unsuited to their present type of duty. One room can readily handle this excess, because these individuals may use the same production line as the applicants to have their eyes and urines checked before being diverted to what may be called the recheck room.

Because of the manifold problems facing the medical officer in charge he must be a cross between physician, administrator, father confessor and diplomat.

As a physician he is called upon to make all final decisions for acceptance or rejection of labor. This is not so easy as it seems, particularly during wartime. Inasmuch as the services have first call, it is readily seen that those left for employment come under the following classes:

1. Military rejects.
2. Military discharges.
3. Married and having dependents.
4. Physically handicapped.
5. Aged.

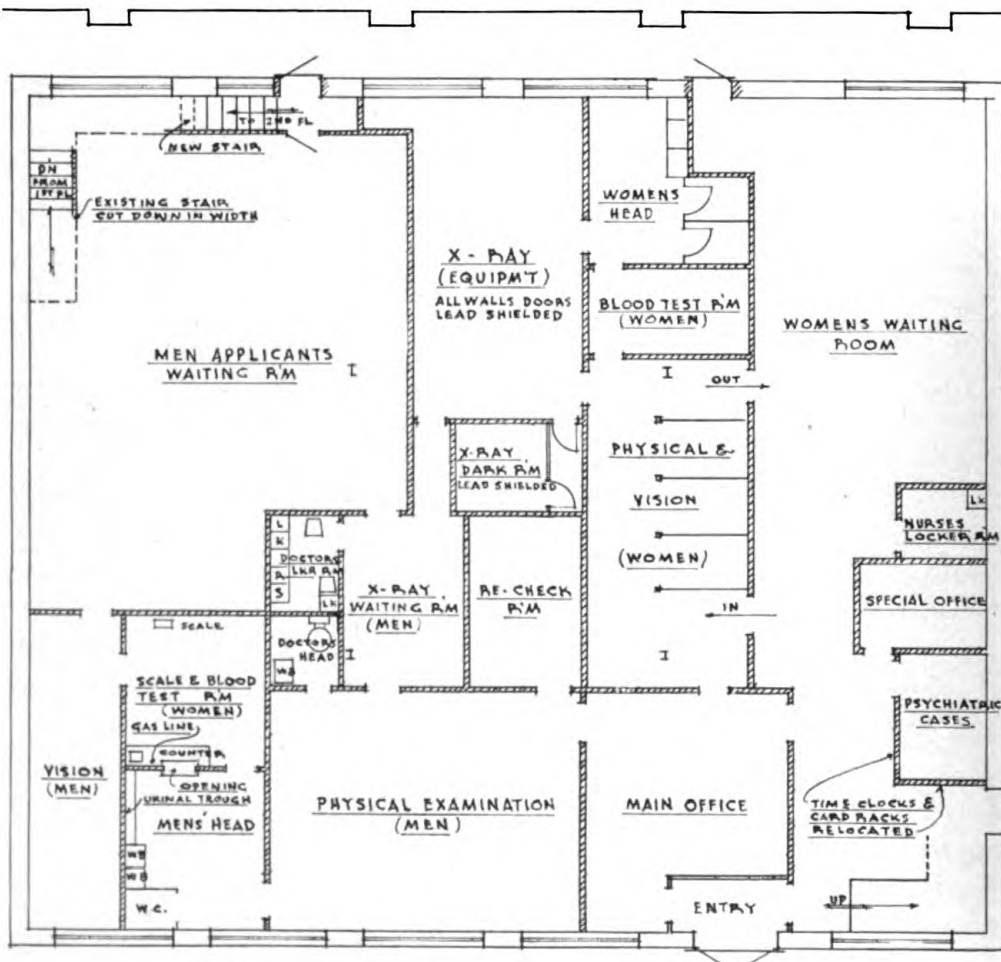
The military rejects, an astonishingly large group, make capital of their rejection and create many problems. They feel that inasmuch as they will not be taken for military service and have a defect, in many instances a minor ailment, they are entitled to special consideration in placing them at jobs suitable to their temperaments. An example of this is the individual with a perforated ear drum who desires work as a laborer in the Navy Yard, but before employment tells you that he cannot stand noise, outdoor work, cold or heights. Another would be the man rejected for hammertoe, who says he can only work so many hours, and those preferably sitting down.

The military discharges are probably the most troublesome group. There are many reasons for this. In the first place, these men did not make good in the services. Many are psychoneurotic, and tell you in advance that owing to their psychoneuroses they are inadequate and must therefore have special consideration.

Naturally every effort is made to place these men at work, but unfortunately they often repeatedly return to the medical office for all sorts of fancied illnesses and wrongs until it finally becomes necessary to discharge them. Their attitude seems to be that their military service placed an obligation upon the Government to take care of them. Often those causing the most trouble are the men who have seen no action but were discharged early in their military careers. Special efforts are directed toward placing returned wounded veterans. These individuals do a good job and rarely return to the Labor Board with complaints.

The third group, namely those having dependents, is not too great a problem, as the majority desire steady work.

The group composed of the aged and physically handicapped is to the lay mind pathetic, but the physicians must of necessity evaluate the possibility of their usefulness to the war effort and to the possibility of giving them the opportunity to become self-supporting. Here the medical officer is called upon to use his special knowledge



2. Floor plan of Labor Board Medical Office.

of jobs and shops, in order to place these individuals in spots where their infirmities are least likely to impede their work or cause them to have an accident. Our experience has been that once placed in the proper job, these people are grateful, do not cause trouble, and expect no favoritism.

The medical officer must know what type of work is being done in the various shops and the hours required day or night, in order that he may reject those unsuited for a certain type of work, and have them rescreened for jobs that they are physically able to handle. An example of this would be an individual with chronic sinusitis. It

would be absurd to place him in the welding shop with its fumes but he could be used as a clerk, in the machine shop, or as a chauffeur. This phase of the work of the medical officer could be elaborated upon at great length.

As a physician too, the medical officer sees all those who have been absent from duty for varying periods of time. Here he deals with employees who have been home ill, at hospitals for operations, mental cases, inebriates, and so forth. Whom to believe and whom not to believe is something that is only learned by experience. How to handle these individuals—for their own good and the good of the yard—is something that must be inculcated and learned by daily contact.



3. Female examining room showing individual booths.

As a father confessor, the medical officer is called upon to hear the myriad problems, familial and otherwise, and to advise, if possible, those employees who have real or fancied grievances. He should be patient and is frequently able to save labor for the yard that would otherwise be lost to the detriment of both the worker and the activity.

His needs for diplomacy are many. In addition to the individual there are so many agencies, local and Federal, to satisfy, that the medical officer frequently finds it difficult to please all concerned. Safety engineers naturally are anxious to avoid accidents and therefore raise their eyebrows when the physically handicapped are hired. Production officers particularly desire skilled labor, and frown when it

is rejected. Records desire quantity and also have to show records to justify their efforts. Medical officers see no reason for taking on labor that is below standard. Politicians feel that their constituents are of primary importance, and to please all concerned is in itself a job for an emissary of the State Department.

Most Naval medical officers are not eager to obtain an assignment to duty on a Labor Board. This is primarily due to ignorance on their part as to the opportunities such duty offers. The Labor Board is the one spot that offers a great variety of clinical medicine. Here one sees the numerous pathologic entities in rejected individuals who therefore are not encountered later as employees. Inasmuch as this work is so important, the medical officer should be carefully selected. Mature judgment is essential. Patience, always a virtue, here becomes a necessity. Adaptability is an attribute that also makes for a successful Labor Board physician.

The duties are largely those of physical examination. This does not only apply to applicants for employment, but also to those who are already employed and have become ill or injured.

Although applicants are examined in groups, thoroughness in examination pays big dividends. First, the physician himself is compensated by the knowledge of work well done, and because he uncovers a wealth of pathologic findings of great clinical interest. Second, the applicant who is frequently unaware of his illness is grateful. He is directed to his personal physician for treatment. Third, the yard is saved endless and needless follow-up physical examinations. Fourth, the clerical force is saved great quantities of paper work and records. Fifth, the Government is benefited financially by not having to pay maximum salaries for work that is necessarily mediocre, and does not have to reimburse or pension doubtful cases that could have been diagnosed on initial physical examination. Finally, the Medical Department of the Labor Board benefits by not having to recheck continually an individual who must remain home from work for an infirmity that should have been demonstrable on admission.

The assistance of a trained cardiologist is of inestimable import in evaluating both the effective work-capacity of applicants and the actual cardiovascular disability of those requiring recheck physical examinations. The clinical pictures encountered deviate from their natural presentation as seen in private practice. The preemployment picture is complicated by a natural desire to minimize, while the recheck individuals grossly exaggerate all possible complaints. In either case these misrepresentations must be penetrated by a trained clinical sense.

Complementing the entire gamut of cardiovascular diseases, from the benign functional disorders to advanced decompensation, is a

wide range of occupations, from day-long watchful waiting to arduous physical exertion. Assuming the accuracy of diagnosis, many individuals with cardiovascular abnormalities may be properly fitted to appropriate jobs. Another thought that constantly intrudes itself during these days of national emergency, is the expendability of labor in the total war effort. It is often tempting on the discovery of a more serious abnormality for the examiner to advise the applicant to return home to the ministrations of his own physician and refrain from seeking employment. However, these individuals are entitled to earn a livelihood, and if not employed in Government defense work will expend themselves in unrelated industries. Therefore it becomes incumbent upon the medical officer in charge to use judgment in accepting and utilizing these people.

It would of course simplify matters if standards could be established correlating cardiovascular diseases with occupational effort. Unfortunately the infinite variations in the symptom thresholds to physical disabilities preclude such rigid tabulations.

A full-time psychiatrist is almost essential. His functions are many, the interviewing of apprentices being among the most important. These boys, all 16 years of age, are sent to the psychiatrist only if they failed to complete $2\frac{1}{2}$ years of high school or if they have histories or stigmata of neuropsychiatric conditions. A quick psychometric examination is given them and a fair number are found unfit because of various degrees of illiteracy, mental deficiency or psychopathy.

The remainder of the psychiatrist's time is devoted to interviewing older applicants who on preliminary screening or physical examination revealed evidence of psychiatric trends or histories of previous mental illness, and to reexamining employees whose complaints seem to fall within the field of psychiatry.

Many applicants are desirous of Federal employment in spite of handicaps which render them totally unfit. Histories of epilepsy, relapsing psychoses and severe psychoneuroses are frequently discovered in time to prevent harm to the organization, the individual or his fellow workers. Discharged service men furnish a serious problem. Every effort is made to place them, in spite of previous failure to adjust to the military service. In general it may be said that those discharged because of inaptitude, lack of adaptability, or traits of character undesirable for the service, are also undesirable for employment in the yard, raising again the old, old question of what to do with or for the psychopathic individual. Those discharged because of war neuroses may adapt to civilian employment and are given every opportunity to try.

Reexamination of employees who have been out of the yard because of illness, or who are sent to the Labor Board on their own or their supervisor's application, discloses many conditions requiring psychiatric investigation. Neuroses arising out of employment, recrudescence of old mental illness, and problems of adjusting miscast characters are among them. Parts of this work may be done by a qualified psychologist. Some naturally fall only within the realm of the physician whose neurologic and psychiatric training includes practical psychology.

Within the sphere of activity of the medical division of the Labor Board in this Navy Yard is included the medical supervision of between some 6,000 and 7,000 female employees.

Like the men, prior to employment, they are given a fairly complete physical examination, including urinalysis, Wassermann test, and x-ray of the chest, but unlike the men, they are examined individually in separate cubicles, rather than in groups. Difficulties have rarely been encountered in examining such patients. The accompaniment of a nurse or Wave, plus the gentle and understanding approach of the examining physician, will almost negate the resistance shown by a supersensitive or nervous applicant.

The physician's manner must at all times avoid unnecessary fectiousness and be above reproach. Such behavior, while expected of all Naval medical officers, is repeated here for the sake of emphasis. While a trained gynecologist is most desirable, he may not at all times be available. Any of the more mature medical officers can qualify for this type of work.

Pelvic examinations, either by the vaginal or rectal route, are not done routinely. Such examinations are done only when indicated and with the written consent of the patient. Her signature is affixed to a printed permit form which is witnessed by the examining physician and the medical officer in charge. The value of such examinations may be easily discerned, when one remembers that the women of today are employed in what may be called heavy industry, as welders, machinists' helpers, and chauffeurs. Prolapsed uteri, pelvic tumors, and so forth, are not conducive to profitable production and under the stress of heavy industry with long working hours, may prove disastrous to the employee. On the other hand, a small asymptomatic fibroid, or a moderate prolapse need not disqualify women from clerical work, which in its broad meaning applies to stenographers, secretaries, teletype operators, engineering and ordnance examiners, and draughtsmen.

The nurse in a Labor Board is required to do the routine work of her calling, as in any Naval setup. She supervises the women's division and is responsible for the linens, cleaning and sterilization

of instruments, and the supervision and assignment of the WAVES in her division.

The corpsmen and WAVES assist materially in the handling of the applicants. While many of their jobs are specialized, nevertheless it has been our policy to have a rotating service, in so far as possible, because, as in any Naval organization, the personnel are subject to orders. When this occurs the routine is not overly disturbed when all individuals are familiar with all jobs.

Corpsmen and WAVES must be trained to examine vision and hearing. This of course is always subject to checkup in doubtful cases. They are trained to withdraw blood for Wassermann tests as well as to weigh and measure the applicant. The senior corpsman instructs applicants about future medical disabilities when employed and he also keeps the daily statistics, daily Wassermann report, and at the end of the month compiles a full statistical report of the work done.

WAVES are utilized to act as chaperons in the female examining room, to write up the results of physical examinations and for routine work.

During wartime when labor is scarce it becomes the duty of all concerned to conserve it as much as possible. In our case this has been accomplished by invoking a system whereby those physically incapable of doing the job for which they have been selected may be re-screened for another job. The system used is to have the applicants interviewed prior to physical examination and the interviewing officer sends a card to the Labor Board medical officer on which is placed:

1. The applicant's name.
2. The date of interview.
3. The job for which selected.
4. The shop or place in which he will be required to work.

When the applicant is examined and a physical defect noted which would not be completely disqualifying for employment, these cards are consulted. If the defect is of such nature that he could not perform efficiently the duties of his rating, he is then rejected *for that job* and a note to that effect placed upon the card. He is then returned to the interviewing officer to determine whether there is another job to which he would be more suited. An example of this would be a man with a weak leg from poliomyelitis, who could be used on the ground but not in a job involving climbing of ladders, where his infirmity would constitute a definite hazard. When an individual is rejected for employment the card showing the reason for rejection is returned to the Screening Board for use in compiling the records.

No Labor Board program can be complete without a definite cooperative association with the industrial hygiene and sanitation department of the medical division.

One of the methods in which cooperation is accomplished is through the control of communicable diseases, of which venereal disease and tuberculosis are the most important. In order to enable the preemployment examination to proceed with celerity, the taking of the blood for serologic tests and the referral for x-ray is integrated in the preemployment examination at the Labor Board. The necessary follow-up on cases with definite or suspicious findings, the provision for the care of those individuals and the reporting of the same to the local public health authorities is the responsibility of the industrial hygiene and sanitation department.

In the course of its regular investigations and periodic examinations of employees engaged in certain occupations, the industrial hygiene and sanitation department may discover instances in which the reclassification of employees is necessary. Should this be required, the cases are referred to the Labor Board and the reclassification is arranged on a consultive basis between the two departments. In this way they function together in fitting the employees to the job for which they are best adapted.

The physical examination is complete, not only for the new applicant, but also for that group referred to as coming under the heading of "special examinations or rechecks." Employees returning to work after an absence due to nonindustrial or occupational diseases, injuries, or extended maternity leaves, as well as those whose well-being is questioned by their supervisors when their productive ability has not come up to standard, are examined with a view to establishing their fitness to return to their specific duties.

This question of recheck physical examinations that daily confronts the Labor Board medical officer, is one that may only be solved by insight, patience, human understanding, and a knowledge of the problem involved. Human nature being what it is, many difficulties present themselves because of fancied grievances and because of their belief in the old adage that "The grass is always greener in the other fellow's yard."

In general, the problems resolve themselves into three main groups: First, those desiring change of duty, either type, place, or time. Second, those needing or recovering from surgical procedures. Third, those returning to work after a nonindustrial illness.

The first group deals with those who feel that their physical condition is impaired by the type of work they are doing. At times there may be some basis for their complaints, but usually not. In many instances their personal physicians inadvertently foster their ideas by giving them notes regarding their ailments. With this note as a lever they feel that they can pry their way into an easier type of job. Unfortunately, the private physician has no knowledge of the work

done by these individuals. When examined by the Labor Board medical officer and found suitable they raise a "hue and cry" about what their doctors told them. It can be readily understood that such a situation can only be met with the acme of tact.

In this group are the restless souls who are never satisfied with the type of work they are doing and want to be transferred. If this sort of thing were fostered, the entire productive structure of the yard would soon become disorganized. Then, too, there are those looking only to their comfort. In the summer their physical condition demands outdoor work and in the winter only the comforting heat of a shop suits their temperaments.

An amazing number have their health adversely affected by lifting, standing, or climbing. They present such heart-rending stories that one wonders how they get along in their own homes. One such individual, upon applying for a job as a laborer in this yard, said "What I want is an easy job, better it should be sitting down and the pay should be good." That individual had the nerve to express a philosophy that I am sure motivates many.

Why so many "systems" seem to be upset only by night work and why all symptoms appear miraculously just when the individual is ordered to this duty, is always puzzling. If the medical officer entertains a reasonable doubt, the employee feels a sense of personal injury because his integrity has been questioned.

What to do about the sudden onset of claustrophobia that never existed prior to being asked to work in tanks or double bottoms? Although taught in medical college that this condition started in childhood and usually lasted throughout life, this observer now finds that it has an acute onset. Why is the waterfront so much damper than shops one short block away? Men cannot work on a ship because the dampness affects their arthritis, but amazingly the same man has no trouble in a nearby shop. There are those who cannot work low, who cannot work high, are allergic to many things encountered in the yard, who cannot stand fumes, climb ladders, stand noise, or who are made dizzy by lights, etc.

The second group, namely, those recovering from or requiring surgical procedures, is a much simpler group to handle. Here personalities are not involved, merely facts. One does or does not require an operation. If required, the necessary allowance of time may be arranged, and postoperatively time for rest and recuperation may be recommended and obtained.

The third group, namely those returning to work after nonindustrial illnesses, comes under two main classifications. First the bona

fide cases and second the malingerers. The bona fide cases who have been ill present themselves with a logical story and a note from the doctor who took care of them. They are usually glad to return to duty and the cordial relation between physician and Yard worker may be enhanced by a few words of welcome and inquiry as to how they feel. It is these small things that help to make for mutual satisfaction. Some of these people have not been ill enough to require the services of a physician but have been attended by wives and relatives using home remedies. Their notarized statements are readily accepted in this event. Some have not been ill, but due to familial conditions beyond their control, they found it impossible to come to work. This is understandable and a judicious regard for the circumstances involved should be shown on the part of the medical officer.

The malingerers are readily recognized. Many of them are repeaters and for this type of chronic absenteeism a judicious warning often proves most efficacious. The mere presentation of a doctor's certificate does not make the case bona fide. Some doctors are imposed upon by family patients who tell them a note is necessary to keep their jobs in the Navy Yard.

Medically the following dispositions can be made of these rechecks:

1. The individual is fit for his or her job. By fit we refer to the Navy usage—fit for duty ashore or afloat, and hence they can perform any task that is required of them in line with their jobs.

2. They are fit for limited duty only. This type of duty carries with it limitations in grade and salary. It is used for individuals who because of infirmity cannot climb ladders, work nights, work outdoors, and so forth.

3. They are temporarily unfit for duty. This applies to anybody acquiring a nonindustrial illness which gives rise to hyperpyrexia, in fact to any condition that the medical officer believes requires rest or therapy by a private physician at home. When granted, a definite time is always stipulated.

4. They are permanently unfit. This is indicated by the neurologic or physical findings.

In order to evaluate the work done on a Labor Board and to inform the commanding officer and those interested as to the status of the labor employed it becomes necessary to submit periodic reports. At this establishment these reports are forwarded monthly. For absolute knowledge and statistical purposes they must be as complete and comprehensive as possible. To have a complete cross section of the labor situation it is not only necessary to have numbers involved but also percentages. For this reason the monthly reports are made up as shown on page 201.

Date_____

From: Medical Officer in Charge, Labor Board, Examining Room.

To: Senior Medical Officer.

Subject: Report of physical examinations held at the Labor Board for _____
(Month)_____
(Year)

1. Total number of physical examinations for employment :

Male_____	(Number)
Female_____	do
Total_____	do
2. Total number of physical examinations for recheck :

Male_____	do
Female_____	do
Total_____	do
3. Total number of rejections : (preemployment)

Male_____	do
Female_____	do
Total_____	do
4. Cause for rejections : Male—

List_____	do
-----------	----
5. Cause for rejections : Female—

List_____	do
-----------	----
6. Percentage of rejections :

Male_____	(Percent)
Female_____	do
Total_____	do
7. Wassermann test :

Male_____	(Number)
Female_____	do
Total_____	do
8. Total number of positive Wassermanns :

Male_____	do
Female_____	do
Total_____	do
9. Percentage of positive Wassermanns :

Male_____	(Percent)
Female_____	do
Total_____	do
10. Psychiatric consultations : (preemployment and rechecks)_____ (Number)

An analysis of this report readily demonstrates the type and causes for rejection by the Medical Department. At the present time the statistics are not comparable to those encountered during times of peace. This is necessarily so because of the fact that applicants seeking employment are to a great extent those unsuited for military service. Then too there is a greater abundance of female labor.

While it is impossible to present all phases of medical Labor Board activities, nevertheless it is felt that this article presents a true cross section of what a physician may hope to encounter in this type of work.



HOW TO BREAK OFF ALCOHOL

Results of a method of curing a taste for drink show that by its means a considerable number of confirmed heavy drinkers have abstained for periods varying from six months to five years. The number of patients treated was 1,042 by last year. The method makes use of a conditioned reflex. The patient, who must be willing to be cured, attends for four to eight treatments, which may be given over a period of from seven to twenty-eight days. When he comes he is given his favourite drink to which a dose of emetine hydrochloride has been added. The dose is in the neighbourhood of one grain. This leads to nausea; and when this appears a further dose of emetine is injected which causes vomiting in two to eight minutes. By repeating this procedure several times on different occasions the patient then finds that he becomes nauseated and vomits when he takes a drink which does not contain emetine; and even the smell alone causes nausea.

A careful follow-up of nearly all patients, revealed that out of a total of 1,042 treated in 5½ years, 86 percent abstained for 6 months and 76 percent for twelve months. About 60 percent abstained for three years; but after five years only 40 percent held off. The decline in the strength of the conditioned reflex is of course to be expected unless it is reinforced from time to time by a repetition of the treatment. This method has been used on chronic alcoholics who appear in court and who wish to be cured; they are detained for thirty days. It is regarded as the only effective method of treating alcoholics. They must however be willing.—Editorial. How to break off alcohol. Brit. M. J. 1: 399, March 18, 1944.



DIASONE

The really newest chemotherapeutic agent is one recently announced named "diasone." It is most interesting because of its chemical structure and its therapeutic possibilities. When neoarsphenamine was developed, it was made as a sodium formaldehyde sulfoxylate derivative of arsphenamine, which improved on the latter greatly. Now pharmaceutical research has hooked two of these sulfoxylate groups to two modified sulfonamide radicals, to produce disodium formaldehyde sulfoxylate diaminodiphenyl-sulfone, or diasone. What makes this particularly significant is that experimental and clinical trial seems to promise that diasone is effective against tuberculosis.—HOLLAND, M. O.: New developments in pharmaceutical practice. Am. J. Pharm. 116: 102-119, March 1944.

EXPERIMENTAL PROPHYLAXIS AND TREATMENT OF CHANCROIDAL INFECTION ¹

INEFFICACY OF PENICILLIN ADMINISTERED INTRAMUSCULARLY

ARMAND J. PEREYRA

Commander (MC) U. S. N.

and

SIMEON LANDY, M. D., M. R. C. S. (Eng.)

The success attending the use of penicillin in the treatment of gonorrhea and syphilis (1) (2) has brought into question the possible value of this drug in the treatment of other venereal diseases. In the case of chancroidal infection, the answer is of particular interest because of the not infrequent occurrence of mixed infections with *Treponema pallidum* and *Haemophilus ducreyi* and the increasing use of penicillin in treatment of early syphilis. A study of the effect of penicillin treatment upon experimentally produced chancroidal infections in the human was carried out in three patients and the results are reported herewith.

Multiple chancroidal infections were produced in the skin of the thighs of patients being treated with penicillin for other conditions. The inoculum was prepared from freshly isolated strains of *H. ducreyi*.² The organisms were cultured twenty-four hours in ten-percent rabbit serum broth yielding approximately 170,000,000 bacteria per cubic centimeter as determined by Petroff-Hausser count. A 1:30 dilution of the culture with serum broth was used as the inoculum. The inoculations were made by acupuncture through 0.05 cc. of inoculum placed on the skin. Chancroidal lesions developed regularly in three to five days.

The first patient was inoculated at eight sites on the thighs. Treatment, consisting of 10,000 units of sodium penicillin every three hours day and night for seven days for a total of 600,000 units, was begun on the day following experimental infection. The lesions evolved rapidly on the skin in each of the eight inoculated areas and were well-developed by the fourth day. In comparison with infections produced

¹ From the Venereal Disease Research Laboratory, U. S. Marine Hospital, Staten Island, N. Y., and the Department of Dermatology and Syphilology, New York University College of Medicine.

² Courtesy of Frank C. Combes, Third Medical Division, Bellevue Hospital, N. Y., and F. Mortara, Department of Preventive Medicine, New York University College of Medicine.

in other patients not receiving penicillin, the lesions in the penicillin-treated patient developed more rapidly and were more extensive. The infections flourished during the balance of penicillin treatment, at the end of which remission and healing were obtained promptly by oral sulfathiazole medication.

A second patient was inoculated in four areas of the skin of the thighs with a similar suspension of *H. ducreyi*. At the time of inoculation, 5,000 units of penicillin had been given intramuscularly every three hours day and night for fourteen days. Penicillin treatment was continued for two additional weeks following the inoculations. Typical chancroidal infections developed at the site of each inoculation within five days. On the seventh day, aseptic aspiration was made of the purulent material in two of the lesions and this was used to inoculate blood agar slants. The growth in each case showed typical bundles of chain bacilli morphologically characteristic of *H. ducreyi*. After subculture, these organisms were used to inoculate a second patient in whom chancroidal infections were produced.

The lesions produced on the second penicillin-treated patient developed more rapidly and more extensively than those in patients infected with the same inoculum but not receiving penicillin. All of the chancroidal lesions healed readily under treatment with sulfathiazole.

A third patient similarly inoculated on six areas of the skin of the thighs was placed under treatment with penicillin within two hours. Five thousand units of penicillin were given intramuscularly every three hours day and night for fourteen days. Similar, rapidly developing chancroidal lesions were produced. The organisms recovered from the infected areas were cultured and were identified microscopically as *H. ducreyi*. These lesions also responded to sulfathiazole.

CONCLUSIONS

1. These observations indicate that sodium penicillin is not effective in preventing or in curing experimental chancroidal infection of the skin in the human in dosages of five to ten thousand units given intramuscularly every three hours.

2. It further appears, from the rapid development of chancroidal lesions in patients treated with penicillin, that this drug facilitates establishment of chancroidal infection possibly by a lethal effect upon susceptible contaminants.

3. These findings are of interest in connection with the treatment of primary syphilis with penicillin. Failure of resolution of a chancre under penicillin treatment may result where a mixed infection with *H. ducreyi* is present. The presence of these organisms in such a lesion would call for supplementary treatment with sulfonamides to effect complete healing of the lesion.

REFERENCES

1. MAHONEY, J. F.; FERGUSON, C.; BUCHHOLTZ, M.; and VAN SLYKE, C. J.: Use of penicillin sodium in treatment of sulfonamide-resistant gonorrhea in men; preliminary report. *Am. J. Syph., Gonorr. & Ven. Dis.* **27**: 525-528, September 1943.
2. MAHONEY, J. F.; ARNOLD, R. C.; and HARRIS, A.: Penicillin treatment of early syphilis; preliminary report. *Am. J. Pub. Health* **33**: 1387, December 1943.



A CORRECTION IN ANOPHELINE NOMENCLATURE

(Diptera: Culicidae)

A study of the literature and of recently collected specimens from Melanesia reveals that the name of the anopheline heretofore treated as *Anopheles punctulatus moluccensis* (Sw. and Sw. de Graaf), at least for material from the New Hebrides, must be corrected. The following synonymy shows the necessity of designating this subspecies as *Anopheles punctulatus farauti* Laveran because of priority.

1902. *Anopheles Farauti* Laveran, C. R. Soc. Biol. Paris **54**: 908 (♀ only). **Type locality**: Faureville, Ile Vaté [Efate], New Hebrides. **Type material**: present location unknown. Pertinent descriptive facts: "Coloration générale brun foncé, noirâtre. Tête: Ecaillés brunâtres, courtes à la nuque. Proboscide de même longueur que les palpes, blanchâtre à l'extrémité apicale [labella]." [General coloration dark brown, blackish. Head: scales brownish, short on the nape. Proboscis of the same length as the palpi, whitish at the apical extremity.]
1920. *Nyssorhynchus annulipes* var. *moluccensis* Swellengrebel and Swellengrebel de Graaf, Geneesk. Tijds. Ned.-Ind. **60** (1) : 29, [Received in USNM Library, June 8, 1920] (♂♂ and ♀♀). **Type locality**: None given, but the following collection localities are listed: Boeroe (Lisela, Namlea), Amboina (Roemah tiga, north coast of Binnenbaai, Gelala, Paso and Ambon), Ceram (Piroe, Boelabaa, and Amahei), Halmaheira (Gita and Maidi), Ternate, Batjan (Laboeha), Sanana and Bandaneira in the Moluccas; and Kokas and Kaimana in Dutch New Guinea. **Type material**: present location unknown. Pertinent descriptive facts: "Proboscis zwartbruin, oliva geelbruin . . . Nog doet de vraag zich voor of deze vorm mogelijk identiek is met Dönitz' punctulata, maar dit denkbeeld moet door de eenkleurigheid der proboscis van de eerste [*moluccensis*] verworpen worden." [Proboscis dark brown, labella yellowish brown . . . Further, there is the question whether this form is possibly identical with *punctulata* Dönitz; however this idea must be discarded because of the unicolorous proboscis of the former.]
1921. *Anopheles punctulatus* var. *moluccensis* (Swellengrebel). Edwards, Bull. Ent. Des. **12** (1) : 71. Variety not fully accepted.

but no strict synonymy indicated. Species association changed.

1924. *Anopheles (Myzomyia) punctulatus* Dönitz. Edwards, Bull. Ent. Res. 14 (4) : 354 [Type form]. Obvious error, in which he somehow reversed the concept of the subspecies, i. e., describes *punctulatus* (type form) as having a dark proboscis.
1927. *Anopheles (Myzomyia) punctulatus* Dönitz. Buxton and Hopkins, Res. in Polynesia and Melanesia, pp. 67-74. Mistaken identification of material from New Hebrides, resulting from following Edwards, 1924.

Only specimens with entirely dark probosces (excluding the labella) were found during the course of over a year's collecting in the coastal areas of the islands of Efate and Espiritu Santo (along with one collection from Port Sandwich, Mallekula Island) in the New Hebrides group by the senior author. There is, of course, the possibility of the introduction at any time of other anopheline species or subspecies.

Further research is necessary before it can be definitely decided whether the New Hebridean *farauti* is identical with *moluccensis* of the Moluccas and the remainder of Melanesia, although this seems quite possible. All material (several hundred specimens) seen to date from the Solomons and from eastern New Guinea would indicate this. However, de Rook (Geneesk. Tijds. Ned.-Ind. 64 : 642-656, 1924) indicates that a considerable amount of variation in the color of the proboscis exists in western New Guinea where most of the females determined by him as *moluccensis* have a ventral pale area on the apical quarter of the proboscis. Consequently, because of de Rook's investigations, and in the absence of material from the Moluccas and western New Guinea, we are unwilling to synonymize the *moluccensis* of the Dutch entomologists with *farauti*.—KNIGHT, K. L., and FARNER, D. S.: Correction in anopheline nomenclature (diptera: culicidae). Proceedings of Entomological Society of Washington 46(5) : 132-133, May 1944.



DIFFERENTIAL DIAGNOSIS OF EFFORT SYNDROME

The differential diagnosis between effort syndrome and organic disease of the heart should not be difficult. When "functional" apical systolic murmurs are present one should hesitate to regard the condition as effort syndrome. The possibility of the existence of hyperthyroidism will often be suggested, but in this disease the hands are unduly warm and the pulse is moderately collapsing in type, while in effort syndrome the hands are cold and the pulse is sustained.—GORDAN, K.: Effort syndrome. Canad. M. A. J. 50: 362-363, April 1944.

RESULTS OF PENICILLIN TREATMENT OF SULFONAMIDE-RESISTANT GONORRHEA

**SUMMARY OF 4,439 CASES TREATED IN UNITED STATES NAVAL HOSPITAL
JULY 1943-MARCH 1944**

WALTER H. SCHWARTZ
Commander (MC) U. S. N.
and
CARY O. EDGE
Chief Pharmacist U. S. N.

Since 5 July 1943, when a "Letter of Information and Instruction on the Use of Penicillin" was issued by the Surgeon General to a number of U. S. Naval hospitals, a total of 4,439 cases of sulfa-resistant gonorrhea has been treated with penicillin. The results as reported by these hospitals to 1 March 1944, and compiled by the Division of Preventive Medicine are summarized in table 1.

COMMENTS

1. Of 4,439 cases of sulfa-resistant gonorrhea treated with penicillin, 4,258 (95.92 percent) were recorded as successes on the first course of therapy.

2. There were 181 cases reported as failures on original treatment. Of these, 139 were re-treated successfully; 2 were definitely classed as failures despite re-treatment. The remaining 40 cases, though reported as failures, ostensibly were not re-treated.

3. Many methods of administration have been employed. The majority of cases, however, have been treated either intramuscularly or intravenously. As expected, the trend is toward the more facile method, and the ratio of intramuscular injections to intravenous has increased from two to one to more than sixteen to one. Other data support the wisdom of this natural trend.

4. Total dosage has definitely decreased. The average dosage of 125,000 units intramuscularly prior to November 1943, decreased to 71,000 units in February 1944 with an over-all average of 99,000 units per case. The average intravenous dosage prior to November 1943 was 171,000. This decreased to 71,000 units as of February 1944. However, the intravenous average for the total period remains high, at 152,000 units per case.

TABLE 1.—Summary of sulfa-resistant gonorrhea cases treated with penicillin at Naval hospitals

Hospital	Number cases treated						Average dosage per case treated (in thousands)			Result of treatment ¹																
	I. M. I. V. Other N. S.						I. M. I. V. Other N. S.			Number successes					Number failures											
										I. M.		I. V.		Other		N. S.		I. M.		I. V.		Other N. S.				
Total	I. M.	I. V.	Other	N. S.	I. M.	I. V.	Other	N. S.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.	Orig. treat.	Re-treat.
Total all hospitals	4,439	3,043	624	6	726	92	152	74	92																	
Bainbridge, Md	275																									
Bethesda, Md	262	195	64	3																						
Chelsoa, Mass	162																									
Corpus Christi, Texas	72	60	3																							
Great Lakes, Ill.	454																									
Farragut, Idaho	42																									
Key West, Fla	44																									
Long Beach, Calif	160	83	13																							
Mare Island, Calif	137																									
Oakland, Calif	32	24	1	3																						
Pearl Harbor, Aiea Hcs. T. H.	414	240	97																							
Philadelphia, Pa	162	24	89																							
Portsmouth, Va	443																									
St. Albans, N. Y.	618	352																								
Sampson, N. Y.	111																									
San Diego, Calif	585	462																								
Seattle, Washington	389	169	220																							
Mobile Hospital #5	9																									
Mobile Hospital #8	3																									
Hospital unspecified	65	65																								

¹ Percentages are based on total cases treated by each method.

* 2 cases intra-urethral; one case injection into knee joint.

* Re-treated by 100,000 units intramuscularly.

* No evidence of re-treatment.

* Intraduodenal injection.

* Re-treatment not concluded.

Total summary: 4,439 cases treated: 4,258 original success (95.92%); 139 re-treatment (3.13%); 42 failures (0.94%).

L. M.=Intramuscular.

I. V.=Intravenous.

N. S.=Not specified.

Reports received prior to 1 March 1944
Burned, U. S. Navy

5. As the average dosage decreased, the number of cases requiring re-treatment increased. Considerable variation in the dosage of re-treatment therapy has been noted.

CONCLUSIONS

1. Penicillin is the drug of choice in the treatment of sulfa-resistant gonorrhea.

2. Optimum dosage appears to be 20,000 units every 3 hours for 5 doses.

3. Intramuscular administration would seem to be the preferred route.

4. Re-treatment with penicillin is indicated in those cases failing to respond to the first course of penicillin therapy.

5. Re-treatment dosage schedules are still in the process of being standardized.



THE SKIN IN SHOCK

The most reasonable interpretation of the appearance of the skin in cases of shock is that a constriction of its blood vessels is present. The available data appear to indicate that the peripheral vasoconstriction is in the first place a reaction to pain, and with the advance of the condition of shock a reaction to the reduced circulating blood volume and low arterial blood pressure.

Cooling of the skin leads to diminished blood flow, and this has been shown to be due partly to reflex action and partly to direct action of cold upon the vessels of the skin. The reflex effect may extend beyond the part cooled to the opposite side of the body, the consensual reflex. It is thus possible that the condition existing in the skin of patients suffering from shock arises first from reflex vasoconstriction due to the initial injury, and that it is maintained by the continuing coldness of this part of the body. When the circulatory system becomes embarrassed by reduction of blood volume, the skin vessels are constricted, and so the state of coldness persists.—WRIGHT, R. D., and DEVINE, J.: Body temperatures in shock. *M. J. Australia* 1: 21-27, January 8, 1944.

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000 average strength) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau of Medicine and Surgery for the months of January, February, and March 1939-1944:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1939.....	470	423	47	19	168	80
1940.....	548	499	49	21	206	90
1941.....	636	591	45	87	254	62
1942.....	566	519	47	67	223	41
1943.....	577	536	41	78	243	28
1944.....	512	471	41	49	185	26

FORCES ASHORE

1939.....	534	487	47	10	253	41
1940.....	626	583	43	26	300	49
1941.....	805	759	46	140	370	42
1942.....	615	569	46	83	251	26
1943.....	619	580	39	92	278	21
1944.....	550	512	38	59	211	23

FORCES AFLOAT

1939.....	437	390	47	24	125	100
1940.....	493	439	54	17	139	119
1941.....	502	458	44	46	163	78
1942.....	478	431	48	39	175	67
1943.....	425	375	49	24	119	54
1944.....	383	332	51	16	97	36

DISABILITIES OR DISEASES CAUSING INVALIDING FROM THE SERVICE

The following table was prepared from reports of medical surveys received in Bumed during January, February, and March 1944, in

which disabilities or diseases causing invaliding from the service existed prior to entry into the Navy:

Disease class title	Number invalided	Percent total invalided
Total, all disease classes	12, 817	100. 00
Diseases of mind	4, 027	31. 42
Diseases of motor system	1, 374	10. 72
Diseases of digestive system	1, 230	9. 60
Diseases of ear, nose, and throat	900	7. 02
Miscellaneous diseases and conditions	823	6. 42
Diseases of nervous system	756	5. 90
Diseases of respiratory system	684	5. 34
Diseases of circulatory system	586	4. 57
Diseases of eye and adnexa	492	3. 84
Diseases of genito-urinary system (nonven.)	471	3. 67
Injuries	341	2. 66
Venereal diseases	312	2. 43
Diseases of skin, hair, and nails	218	1. 70
Tuberculosis (all forms)	168	1. 31
Herniae	110	. 86
Diseases of ductless glands and spleen	84	. 66
Tumors	76	. 59
Other diseases of infective type	62	. 48
Female diseases and conditions	40	. 31
Diseases of lymphatic system	24	. 19
Diseases of blood	16	. 12
Communicable diseases transmissible by oral and nasal dis- charges	8	. 06
Parasitic diseases (fungi and certain animal parasites)	6	. 05
Dental diseases and conditions	5	. 04
Communicable diseases transmissible by insects and other arthropods	3	. 02
Poisonings	1	. 01
Communicable diseases transmissible by intestinal discharges	0	0

NOTES ON OUR RESERVE CONTRIBUTORS

Allan, John H., Lieutenant Commander (MC) USNR (*Knee Injuries in Service Personnel*, p. 63). A. B., Johns Hopkins University, 1929; M. D., Johns Hopkins University School of Medicine, 1933. Resident, New York Orthopedic Hospital, 1937-39; instructor in orthopedic surgery, Yale University School of Medicine, 1939-40; staff member: Pennsylvania Hospital, Children's Hospital of Philadelphia, Graduate Hospital of the University of Pennsylvania, Women's Medical College of Pennsylvania, 1940-. Member Philadelphia County Medical Society and Pennsylvania State Medical Society. Diplomate American Board of Orthopedic Surgery, 1942.

Amyot, Bruno E., Lieutenant (DC) USNR (*Neurinoma of the Mental Nerve*, p. 125). B. S., Manhattan College, 1934; D. D. S., Georgetown University School of Dentistry, 1938. Intern in oral surgery, Columbia Presbyterian Medical Center, New York City, 1938-39; associate oral surgeon, Troy Hospital, Troy, N. Y., 1940; private practice, Cohoes, N. Y., 1939-. Member: Third District, New York State Dental Society; American Dental Association.

Anderson, Truman O., Lieutenant Commander (MC) USNR (*Protector Sleeve for Hypodermic Syringe*, p. 147). M. D., Hahnemann Medical College, 1918. Intern: Hahnemann Medical College Hospital, May 1917-May 1918; Eye, Ear, Nose and Throat Service, U. S. Naval Hospital, Great Lakes, June 1918-Jan. 1919; Nose and Throat Clinic, Hahnemann Medical College Hospital, June 1919-Aug. 1921; Illinois Charitable Eye and Ear Infirmary, 1921-22; Illinois Post Graduate Hospital, 1922-23; eye surgeon for: Chicago Bridge and Iron Works; Sherwin Williams Co.; Van Etten Bros. Contractors; Great Lakes Forge Co., Chicago; private practice, Chicago, 1919-; staff member, Roseland Community Hospital, Chicago. Member: Chicago Medical Society; Illinois State Medical Society; American Medical Association.

Baer, Louis Shattuck, Lieutenant (MC) USNR (*Normal Blood Elements and Leptospira*, p. 127). B. S., University of Chicago, 1938; M. D., Rush Medical College, 1938. Intern, 1938-39, assistant resident, 1939-40, and resident in internal medicine, 1940-41, University Hospital, Ann Arbor, Mich.; instructor in internal medicine, University of Michigan Medical School, 1941-42. Member Washtenaw County Medical Society. Diplomate National Board of Medical Examiners.

Bean, Lawrence L., Commander (MC) USNR (*A Simple Night Vision Test*, p. 143). B. A., University of Tennessee, 1921; M. D., Vanderbilt University School of Medicine, 1925. Intern, Knickerbocker Hospital, New York City; ship surgeon, United Fruit Line, Oct. 1926-Jan. 1927; postgraduate intern, surgery, New York Post-Graduate Medical School and Hospital, New York City, Jan. 1927-April 1929; attending surgeon, Long Beach Hospital, Long Beach, N. Y., Jan. 1930-Dec. 1940; St. Joseph Hospital, Orange, Calif., 1940-; staff member, Orange County General Hospital, Orange, Calif., 1940-. Fellow American Medical Association; member: California Medical Association; Orange County Medical Society.

Benjamin, H. B., Lieutenant Commander (MC) USNR (*Analysis of Low Incidence of Infectious Diseases at a Secondary Training Center*, p. 114). M. D., Marquette University School of Medicine, 1930. Intern: St. Mary's Hospital, Milwaukee; Milwaukee County Hospital, 1930-31; resident pathologist, Milwaukee County Hospital, 1931-35; private practice, Wauwatosa, Wis., 1931-; pathologist, St. Anthony Hospital; surgical staff Evangelical Deaconess Hospital. Member: State Medical Society of Wisconsin; Milwaukee County Medical Society.

Benson, Clifford D., Commander (MC) USNR (*The Changing Picture of Post-pneumonic Empyema Thoracis*, p. 46). B. S., University of Wisconsin, 1926; M. D., Northwestern University Medical School, 1929. Intern, 1928-1929, senior intern (surgery) 1929-30, resident in pathology, 1930-31, assistant resident in surgery, 1931-32, resident in surgery, 1932-33, Harper Hospital, Detroit; resident in thoracic surgery, Herman Kiefer Hospital, Detroit, 1933-34; instructor in surgery, 1937-40, and associate in surgery, 1940-42, Wayne University College of Medicine; private practice, Detroit, Mich., 1934-; associate surgeon: Children's Hospital of Michigan; Herman Kiefer Hospital; assistant surgeon: Harper Hospital; City of Detroit Receiving Hospital. Fellow: American College of Surgeons; American Medical Association; member: Michigan State Medical Society; Central Surgical Association; American Association for Thoracic Surgery. Diplomate American Board of Surgery.

Bingham, Charles T., Lieutenant Commander (MC) USNR (*Dermatologic Practice in the South Pacific*, p. 17). A. B., Yale University, 1928; M. D., Columbia University College of Physicians and Surgeons, 1932. Intern, Hartford Hospital, 1932-34; assistant resident, medicine, Thorndike Laboratory, Boston City Hospital, 1934-35; practice, internal medicine, Hartford, Conn., 1935-42; assistant visiting physician, Hartford Hospital, 1936-. Fellow: American College of Physicians; American Medical Association. Diplomate American Board of Internal Medicine.

Blaess, Marvin J., Lieutenant Commander (MC) USNR (*Cosmetic Ocular Rehabilitation*, p. 96). A. B., Wayne University, 1929; M. D., University of Michigan Medical School, 1932. University of Chicago Eye Clinic, 1933-34; associate, eye surgery, Wolfe Eye Clinic, Marshalltown, Iowa, 1934-38; attending ophthalmic surgeon, Evangelical Deaconess Hospital, Detroit, Mich., 1938-. Diplomate: National Board of Medical Examiners; American Board of Ophthalmic Surgery.

Brinckerhoff, Albert J., Lieutenant (MC) USNR (*Inflammation of the Macula Lutea*, p. 133). A. B., Stanford University, 1934; M. D., Stanford University School of Medicine, 1938. Intern, Highland-Alameda County Hospital, Oakland, Calif., 1937-38; assistant resident in medicine, Stanford University Hospital, San Francisco, 1938-39; house officer in ophthalmology, San Francisco Hospital, 1939-40; assistant resident in ophthalmology, Stanford University Hospital, 1940-42.

Chiles, George G., Commander (MC) USNR (*Autoplastic Sutures in Repair of Inguinal Hernia*, p. 83). M. D., Medical College of Virginia, 1926. Intern, Stuart Circle Hospital, Richmond, 1926-27; chief resident, 1927-28, and associate surgical staff, 1929-31, Watts Hospital, Durham, N. C.; instructor in surgery, Duke Hospital, Durham, N. C., 1930; chief of staff, Lee County Hospital, Sanford, N. C., 1940. Fellow: American College of Surgeons; American Medical Association.

Closson, James H., Commander (MC) USNR (*Experiment in Psychotherapy During Selection Examining*, p. 39). B. S., Princeton University, 1919; M. D., Hahnemann Medical College and Hospital of Philadelphia, 1923; M. Sc. (Med.) 1934, and D. Sc. (Med.) 1935, Graduate School of Medicine, University of Pennsylvania; instructor, Department of Psychiatry, Graduate School of Medicine, University of Pennsylvania, 1936-42; associate professor, neuropsychiatry, Hahnemann Medical College and Hospital of Philadelphia, 1937-42; assistant neuropsychiatrist: Hahnemann Hospital, 1937-42; Methodist Hospital, Philadelphia, 1937-40; senior physician, Friends Hospital, Philadelphia, 1937-42; assistant physician, psychiatric division, Philadelphia General Hospital, 1936-42. Fellow American Psychiatric Association; associate American College of Physicians; member: Pennsylvania Medical Society; Philadelphia Medical Society; Pennsylvania Psychiatric Society.

Coburn, Alvin F., Commander (MC) USNR (*Precision Bombing in Chemotherapy*, p. 52). B. A., Yale, 1921; M. D., Johns Hopkins University Medical School, 1925. Intern, Presbyterian Hospital, New York City, 1925-27; medical resident, Presbyterian Hospital, Medical Center, New York City, 1927-30; Proudft Fellow, Columbia University, Department of Medicine, 1930-34; assistant professor of medicine, Columbia University College of Physicians and Surgeons, 1934-42; visiting investigator, Rockefeller Institute, 1940-41; attending physician, 1930-42: Presbyterian Hospital; Vanderbilt Clinic; Bellevue Hospital; Willard Parker Hospital; St. Vincent's Hospital, New York City; consultant, Grasslands Hospital, Valhalla. Member: Committee on Public Health Relations, New York Academy of Medicine; Harvey Society; American Heart Association; Society of Clinical Investigation; Society of American Physicians; American Association for Advancement of Science. Author, *The Factor of Infection in the Rheumatic State*, Williams & Wilkins, 1931.

Conley, James E., Lieutenant (MC) USNR (*Application of Caudal Anesthesia to General Surgery*, p. 100). B. S., Providence College, 1935; M. D., Harvard Medical School, 1939. Resident, Cape Cod Hospital, Hyannis, Mass., Oct. 1939-March 1940; surgical house officer, April 1940-41, and assistant surgical resident, April 1941-Aug. 1942, Massachusetts General Hospital, Boston; surgical resident, Wisconsin General Hospital, Madison, Wis., Sept. and Oct. 1942. Member American Medical Association. Diplomate National Board of Medical Examiners.

Cowart, James T., Lieutenant Commander (MC) USNR (*Mediastinal Emphysema*, p. 119). B. S., Mercer University, 1918; M. D., Emory University School of Medicine, 1922. Resident, Philadelphia Hospital for Insane (now Philadelphia State Hospital), Sept. 1922-Jan. 1923 intern: Philadelphia General Hospital, Jan. 1923-Jan. 1925; Children's Hospital, Philadelphia, Pa., Jan. 1925-July 1925; Children's Seashore House at Atlantic City for Invalid Children, July 1925-Oct. 1925; private practice, pediatrics, Tampa, Fla., Jan. 1926-July 1942; staff: Tampa Municipal Hospital; St. Joseph's Hospital, Tampa, Fla.; consultant, pediatrics: Salvation Army Home for Wayward Girls; Children's Home, Tampa, Fla. Fellow American Medical Association; member: Hillsboro County Medical Society, Florida State Medical Association; Southern Medical Society; Florida State Pediatric Society.

Cox, Lawrence K., Lieutenant (DC) USNR (*Anticoncussion Ear Plugs*, p. 139). D. D. S., University of Michigan School of Dentistry, 1931. Dental technician, 1923-31; private practice, Adrian, Mich., 1931-. Member: American Dental Association; Washtenaw County Dental Society.

Davidson, William M., Lieutenant Commander (MC) USNR (*Ultraviolet Irradiation Relative to Anoxia and Bend Susceptibility*, p. 37). B. A., University of Washington, 1929; M. D., University of Rochester School of Medicine and Dentistry, 1933. Extern, Rochester State Hospital, Rochester, N. Y.; intern, Mountinside Hospital, Montclair, N. J., 1934-35; physician in charge, Pan American Airways Second Pacific Expedition, 1936; private practice, Seattle, 1936-40; assistant surgeon, King County Hospital, Seattle, 1936-40; flight surgeon, Pan American Airways Alaska Division, 1939-40. Associate fellow Aero Medical Association; member: Seattle Chapter National Aeronautic Association (president, 1939-40); American Medical Association. Diplomate National Board of Medical Examiners.

DiLeo, Lucian W., Lieutenant (MC) USNR (*Multiple Chancres*, p. 137). B. S., Creighton University, 1939; M. D., Creighton University School of Medicine, 1941. Intern, Sacred Heart Hospital, Allentown, Pa., 1941-42. Member Missouri Valley Branch of American Society of Bacteriology.

Ferguson, L. Kraeer, Captain (MC) USNR (*Surgical Casualties of Amphibious Warfare*, p. 73). M. D., University of Pennsylvania School of Medicine, 1923. Fellow in surgery, Hospital of the University of Pennsylvania, 1923-25; year's study in Europe, 1928-29; Private practice, Philadelphia 1925-; assistant surgeon, Hospital of the University of Pennsylvania, Philadelphia; assistant professor of surgery, University of Pennsylvania School of Medicine; surgeon, Student Health Service, University of Pennsylvania; chief of the proctologic clinic, Hospital of the University of Pennsylvania and Philadelphia General Hospital; proctologist, Policemen and Firemen of Philadelphia; chief of the industrial clinic, Hospital of the University of Pennsylvania. Fellow: American College of Surgeons; American Medical Association; member: Philadelphia Academy of Surgery; American Surgical Association; American Gastro-Enterological Association; Physiological Society, Philadelphia; American Society for Experimental Pathology. Diplomate American Board of Surgery. Author. *Surgery of the Ambulatory Patient*, 1942; coauthor, *Surgical Nursing*, 6th edition, 1940; surgical editor, *Digest of Treatment*.

Fitzgerald, Patrick J., Lieutenant (MC) USNR (*Acute Ascending Paralysis (Guillain-Barré Syndrome)*, p. 4). B. S., Massachusetts State College, 1936; M. D., Tufts College Medical School, 1940. Intern, Boston City Hospital, 1940-42; resident, Mallory Institute of Pathology, Boston City Hospital, 1942-43; assistant pathologist, Mallory Institute of Pathology, Boston, Mass., 1942-43. Diplomate National Board of Medical Examiners.

Geller, John W., Lieutenant (DC) USNR (*Anticoncussion Ear Plugs*, p. 139). D. D. S., Indiana University School of Dentistry, 1932. Chemist for U. S. Steel Co., Gary, Ind., summers of 1926-31; private practice, Indianapolis, Ind., 1932-42; instructor, Indianapolis Denture Study Club. Member: American Dental Association; Indiana State Dental Society; Indianapolis Dental Society; American Full Denture Society.

Genauer, Mortimer B., Lieutenant Commander (MC) USNR (*Anesthesia in Military Medicine*, p. 105). B. S., New York University, 1928; M. D., University of Louisville School of Medicine, 1931. Intern, 1931-32, assistant attending in anesthesia, 1932-, and adjunct attending in surgery, 1937-, St. Vincent's Hospital, Staten Island, N. Y. Member: Richmond County Medical Society; New York State Medical Society; American Medical Association; American Society of Anesthetists.

Glazier, McCleery, Lieutenant Commander (MC) USNR (*Reno-Ureteral Colic*, p. 80). B. S., University of Nebraska; M. D., University of Nebraska College of Medicine, 1936. Intern, Bishop Clarkson Memorial Hospital, Omaha, July 1936–July 1937; fellow in urology, Cleveland Clinic, July 1937–April 1940; resident in urology, Los Angeles County General Hospital, April 1940–September 1940. Member: American Medical Association; California Medical Association; San Diego County Medical Society. Diplomate American Board of Urology.

Greene, Oscar, Lieutenant Commander (MC) USNR (*Impetigo Contagiosa Cured by Fever*, p. 136). B. S., College of the City of New York, 1935; M. D., New York University College of Medicine, 1940. Intern, Fordham Hospital, New York City, 1940.

Harris, Herbert I., Lieutenant Commander (MC) USNR (*Infectious Polyneuritis*, p. 13). B. S., Massachusetts State College, 1927; M. D., Tufts College Medical School, 1936. Instructor, Tufts College Medical School, 1939–41; assistant, neurology: Harvard Medical School, 1940–41; Tufts College Medical School, 1939–41; editor, Bulletin New England Medical Center, 1939–41; psychiatrist, Norfolk State Prison Colony, 1940–41; assistant medical director, Joseph H. Pratt Diagnostic Hospital, Boston, Mass., 1939–41; consultant, neurology and psychiatry, St. John's Hospital, Lowell, Mass. Member: American Medical Association; Massachusetts Medical Society; Boston Neurological Society; Massachusetts Society for Psychiatric Research.

Hildreth, Harold M., Lieutenant H-V(S) USNR (*Experiment in Psychotherapy During Selection Examining*, p. 39). A. B., University of Nebraska, 1927; Ph. D., Syracuse University, 1935. Psychologist, Syracuse Psychopathic Hospital, Syracuse, N. Y., 1932–37; instructor, 1937–38, assistant professor, 1938–40, and associate professor, 1940–, Syracuse University. Member: American Psychological Association; American Association for Applied Psychology; American Association for Advancement of Science; American Orthopsychiatric Association.

Kelly, Francis T., Lieutenant (MC) USNR (*Multiple Chancres*, p. 137). B. S., St. Peter's College, 1936; M. D., Georgetown University School of Medicine, 1940. Intern, Queen's General Hospital, Jamaica, Long Island, N. Y., 1940–42.

Lebensohn, James E., Commander (MC) USNR (*Temporary Stimulation of Emmetropic Visual Acuity*, p. 90). B. S., 1914, and M. S. 1915, University of Chicago; M. D., Rush Medical College, 1917; Ph. D., Northwestern University, 1935. Ophthalmologist and otolaryngologist, U. S. Veterans' Hospital, Ill., 1921–24; assistant professor, ophthalmology, Northwestern University Medical School, 1929–; attending ophthalmologist, Mt. Sinai Hospital, Chicago, 1921–; Cook County Hospital, 1935–; associate ophthalmologic surgeon, Illinois Charitable Eye and Ear Infirmary, 1925–35; visiting ophthalmologist: Passavant Memorial Hospital, Wesley Memorial Hospital, Chicago, 1941–. Fellow American College of Surgeons; member: American Association for the Advancement of Science; American Academy of Ophthalmology and Otolaryngology; American Medical Association; Chicago Ophthalmological Society; Chicago Society for the History of Medicine; corresponding member Mexican Ophthalmological Society.

Lulow, William V., Lieutenant (MC) USNR (*Analysis of Low Incidence of Infectious Diseases at a Secondary Training Center*, p. 114). A. B., Yale University, 1933; M. D., Tufts College Medical School, 1937. Intern, Brockton

Hospital, Brockton, Mass.; assistant resident, pediatrics, Boston Floating Hospital; junior assistant physician, pediatrics, Boston Dispensary, and Tufts College Medical School (now on leave of absence). Member: American Medical Association; Massachusetts Medical Society.

McGinn, Sylvester, Lieutenant Commander (MC) USNR (*Rheumatic Fever and Acute Arthritis as Causes for Evacuation From South Pacific Area*, p. 1). A. B., Dartmouth, 1926; M. D., Harvard Medical School, 1929. Intern, Rhode Island Hospital, Providence, R. I., 1930-31; resident in cardiology, Massachusetts General Hospital, Boston, Mass., 1931-33; instructor, Post Graduate School of Medicine, Harvard University; assistant in medicine, Massachusetts General Hospital; assistant physician, St. Elizabeth's Hospital, Boston; cardiac consultant: Robert Breck Brigham Hospital, Boston; Sturdy Memorial Hospital, Attleboro, Mass.; Cape Cod Hospital, Hyannis, Mass.; McLean Hospital, Belmont, Mass. Fellow American Medical Association; member: Massachusetts Medical Society; American Heart Association.

McLaughlin, Charles W., Jr., Lieutenant Commander (MC) USNR (*The Changing Picture of Postpneumonic Empyema Thoracis*, p. 46). B. S., University of Iowa, 1927; M. D., Washington University School of Medicine, St. Louis, 1929. Intern, 1929-30, and resident in pathology, 1930-31, Montreal General Hospital; fellow in surgery, University Hospital, University of Pennsylvania, 1931-34; graduate study, Royal Infirmary, Edinburgh, Scotland, 1934-35; private practice, Omaha, 1935-; assistant professor, surgery, University of Nebraska; surgeon: University of Nebraska Hospital, Nebraska Methodist Hospital, and Bishop Clarkson Memorial Hospital, Omaha. Fellow American College of Surgeons; member: Nebraska State Medical Society; American Medical Association; Central Surgical Association; Western Surgical Association. Diplomate American Board of Surgery.

McLaughlin, Richard F., Lieutenant Commander (MC) USNR (*Coccidioidomycosis*, p. 122). B. S., Creighton University, 1926; M. D., Creighton University School of Medicine, 1930. Intern, Dr. W. H. Groves Latter-Day Saints Hospital, Salt Lake City, 1930; associate, Salt Lake Clinic, Salt Lake City, 1931; private practice, Price, Utah, 1932-41; instructor, Dept. of Medicine, University of Utah, 1940. Fellow: American Medical Association; American College of Physicians; member: American Heart Association; Utah State Medical Association.

Michael, Paul, Commander (MC) USNR (*Coccidioidomycosis*, p. 122). M. D., McGill University Faculty of Medicine, 1928. Intern, Highland-Alameda County Hospital, Oakland, 1928-29; resident, pathology, California University, 1929-31; assistant pathologist, Highland-Alameda County Hospital; pathologist: Children's Hospital of the East Bay, Oakland; Peralta Hospital, Oakland; associate pathologist, California University. Fellow American Medical Association; member: American Society of Clinical Pathologists; International Association of Medical Museums. Diplomate American Board of Pathology.

Mullen, Edward A., Captain (MC) USNR (*The Safe Universal Donor*, p. 32). P. D., Philadelphia College of Pharmacy and Science, 1913; M. D., Jefferson Medical College of Philadelphia, 1917. Assistant professor of urology, Graduate School, University of Pennsylvania; urologist: Philadelphia General Hospital; Graduate Hospital of the University of Pennsylvania; Memorial Hospital, Philadelphia; St. Luke's Hospital, Bethlehem, Pa. Fellow: American Medical Association; American College of Surgeons; member American Urological Association.

Nicholson, Jesse T., Commander (MC) USNR (*Knee Injuries in Service Personnel*, p. 63). B. S., University of Pennsylvania; M. D., University of Pennsylvania School of Medicine, 1928. Intern, Pennsylvania Hospital, 1928-30. Resident, orthopedics: Philadelphia Orthopedic Hospital, 1930-31; Shriners' Hospital for Crippled Children, Philadelphia, 1932; Johns Hopkins Hospital, 1932; Massachusetts General Hospital, Boston, 1933. Private practice, Philadelphia, 1934-42; assistant orthopedic surgeon: Graduate Hospital University of Pennsylvania; Philadelphia General Hospital; orthopedic surgeon: Children's Department, Mary J. Drexel Home; Lankenau Hospital; Pennsylvania Hospital; Philadelphia Children's Hospital; Children's Seashore House at Atlantic City for Invalid Children; associate professor of orthopedic surgery, Graduate School of Medicine, University of Pennsylvania. Fellow American College of Surgeons; Member Philadelphia County Medical Association; Pennsylvania State Medical Society; American Medical Association; Philadelphia Orthopedic Club; Philadelphia College of Physicians; Philadelphia Academy of Surgeons; American Board of Orthopaedic Surgeons; Academy of Orthopaedic Surgeons; Interurban Orthopaedic Club; American Orthopaedic Association.

Olson, Clarence, Lieutenant (MC) USNR (*Reno-Ureteral Colic*, p. 80). B. S., University of Chicago, 1928; M. D., Rush Medical College, 1933. Intern, March 1932-March 1933, and resident in surgery, March 1933-July 1934, St. Luke's Hospital, Chicago; private practice, Princeton, Ill., Aug. 1934-. Fellow: American College of Surgeons; American Medical Association; member: Illinois State Medical Society; Bureau County Medical Society.

Russell, William M., Commander (MC) USNR (*Application of Caudal Anesthesia to General Surgery*, p. 100). M. D., College of Medical Evangelists, 1934. Intern, Los Angeles County Hospital, July 1933-Oct. 1934; assistant surgeon for the Mono Basin Project for the Department of Water and Power, City of Los Angeles, Oct. 1934-Sept. 1936; resident surgeon, Metropolitan Hospital, Welfare Island, New York City, part of 1938; County Health Officer and United States assistant collaborating epidemiologist and industrial surgeon, Bridgeport, Mono County, Calif., Aug. 1938-. Member: American Medical Association; California Medical Association; Inyo-Mono County Medical Association. Diplomate National Board of Medical Examiners.

Saxl, Newton T., Commander (MC) USNR (*Medical Department of a Labor Board*, p. 175). M. D., Columbia University College of Physicians and Surgeons, 1919. Associate attending, New York Post-Graduate Medical School and Hospital, 1919-40; assistant attending, Children's Clinic, Lenox Hill Hospital, New York City, 1937-40; past chairman, District Health Committee, New York Health Department, Kips-Bay-Yorkville Districts, 1937-39; member Board of Directors, Camp Ramapo, 1929-38. Fellow: American Academy of Pediatrics; American College of Physicians; American Medical Association; member: Medical Society of the County of New York; New York Academy of Medicine; Society for the Advancement of Science. Author, *Pediatric Dietetics*, Lea & Febiger, Philadelphia, 1937.

Sprague, Howard B., Captain (MC) USNR (*Rheumatic Fever and Acute Arthritis as Causes for Evacuation From South Pacific Area*, p. 1). A. B., Harvard College, 1918; M. D., Harvard Medical School, 1922. Intern, Massachusetts General Hospital, Boston, 1922-24; associate physician, Massachusetts General Hospital; instructor, courses for graduates, Harvard Medical School. Fellow: American College of Physicians; American Medical Association; member: Massachusetts Medical Society; American Clinical and Climatological Association;

American Heart Association (secretary); New England Heart Association (president); International Association of Medical Museums. Diplomate American Board of Internal Medicine.

Stearns, A. Warren, Captain (MC) USNR (*Infectious Polyneuritis*, p. 13). M. D., Tufts College Medical School, 1910; D. Sc. (honorary) Tufts College, 1943. Private practice, Boston, 1910-; instructor in neurology and psychiatry, 1914-; Dean and professor of psychiatry (on leave), 1927-, Tufts College Medical School; head of Dept. of Nervous and Mental Diseases, Boston Dispensary; past commissioner of the Massachusetts Department of Correction and associate commissioner of the Massachusetts Department of Mental Diseases, 1929-33. Fellow: American Medical Association; member: American Psychiatric Association; New England Society of Psychiatry. Diplomate American Board of Psychiatry and Neurology.

Stubenbord, William D., Lieutenant Commander (MC) USNR (*Emergency Poison Kit*, p. 154). B. S., Wesleyan University, 1927; M. D., Cornell University Medical College, 1931. Intern, July 1931-Aug. 1932, and assistant resident, Aug. 1932-Sept. 1933, assistant attending physician, New York Hospital; associate visiting physician, Bellevue Hospital. Fellow: American College of Physicians; American Medical Association; New York Academy of Medicine; member: New York County Medical Society. Diplomate: National Board of Medical Examiners; American Board of Internal Medicine.

Sullivan, Daniel J., Lieutenant Commander (MC) USNR (*A Simple Method of Securing Patients to Army-Type Litter*, p. 157). B. S., Harvard College, 1929; M. D., Harvard Medical School, 1933. Intern in surgery, Boston City Hospital, Nov. 1933-Nov. 1935; intern in obstetrics, Boston Lying-In Hospital, Feb. 1936-Aug. 1936; private practice, Nashua, N. H., Sept. 1936-. Fellow American Medical Association; member: New Hampshire Medical Society, Merrimac County Medical Society; New England Obstetrical and Gynecological Society.

Sullivan, Raymond R., Lieutenant Commander II-V(S) USNR (*Temporary Stimulation of Emmetropic Visual Acuity*, p. 90). Opt. D., Pennsylvania State College of Optometry, 1932; LL. D., University of Baltimore Law School, 1940. Intern, Clinics of Pennsylvania State College of Optometry, Philadelphia, 1930-32; private practice of optometry, 10 years, and associate, Maryland Eyesight Clinics, Baltimore, Md., 9 years. Member: American Optometric Association; Maryland Association of Optometrists; State Board of Examiners of Optometry in Maryland.

Sweet, A. Porter S., Lieutenant Commander (DC) USNR (*Processing X-ray Film Under Tropical Conditions*, p. 160). D. D. S., University of Buffalo, 1918. General practice, Hornell, N. Y., 1918; staff dentist, St. James Mercy Hospital, Hornell, N. Y., 1936; consulting dentist, Bethesda Hospital, Hornell, 1937; Editor, Dental Radiography and Photography, 1938; associate editor (radio-dontics), Journal of the Dental Society of the State of New York, 1939; consulting dental radiologist, research dept., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y., 1942. Member: American Dental Association; Dental Society of the State of New York; Seventh District Dental Society; Rochester Dental Society; Pierre Fauchard Academy; American Association for the Advancement of Science (Dental Subsection); International Association for Dental Research; Rochester Academy of Science.

Taylor, K. P. A., Lieutenant Commander (MC) USNR, Retired (*Factors in Efficient Mass Blood Procurement*, p. 25). B. S., Haverford College, 1915; M. D., University of Pennsylvania School of Medicine, 1919. Surgeon resident, University of Pennsylvania Hospital; chief surgical resident, Hospital Santo

Tomas, Panama, R. de P.; formerly chief surgeon, Hospital Cartagena, Cartagena, Colombia, S. A.; instructor in surgery, University of Pennsylvania School of Medicine; assistant surgeon: Philadelphia General Hospital; Stetson Hospital, Philadelphia; assistant urologist; St. Agnes Hospital; St. Mary's Hospital, Philadelphia; attending surgeon, Anglo-American Hospital, Havana, Cuba; superintendent and chief surgeon, United Fruit Co. Hospital, Panama. Fellow: American Medical Association; American College of Surgeons; member: Philadelphia County Medical Society; Medical Society of the State of Pennsylvania. Diplomate National Board of Medical Examiners.

Wheeler, J. A., Jr., Lieutenant, junior grade D-V(S) USNR (*Experiences in the Use of the Kent Battery*, p. 44). A. B., Harvard College, 1928; Ed. M., Harvard University, 1933; University of Chicago, 1934. Psychologist, Harvard G. S. E. Psycho-Educational Clinic, Cambridge, Mass., 1930-33; instructor, Chicago Teachers College, 1933-34; Dean, Eaglebrook School, 1937-41; instructor, Smith College, 1941-42. Member American Association for the Advancement of Science.

Williams, Stanley B., Lieutenant, junior grade H-V(S) USNR (*Experiences in the Use of the Kent Battery*, p. 44). B. A., 1934, M. A., 1937, University of California at Los Angeles; Ph. D., Yale University, 1940. Instructor, psychology: University of Maine, 1940-42; Brown University, 1942-43. Member American Psychological Association.

Witwer Russell G., Lieutenant Commander (MC) USNR (*Airsickness*, p. 34). M. D., Hahnemann Medical College and Hospital of Philadelphia, 1935. Intern, Huron Road Hospital, East Cleveland, Ohio, 1935-36; medical staff: Huron Road Hospital; Grace Hospital, Cleveland. Fellow American Medical Association; member Cleveland Academy of Medicine.

Wood, Harold, Lieutenant Commander (MC) USNR (*Acute Ascending Paralysis (Guillain-Barré Syndrome)*, p. 4). M. D., Tufts College Medical School, 1933. Intern: Newton Hospital, Newton, Mass., 1933-34; Rhode Island Hospital, Providence, R. I., 1934-35; assistant resident, pathology, Medical School of Duke University, 1935-36; instructor in pathology, Medical College of South Carolina, 1936-38; instructor in pathology and bacteriology, Tufts College Medical School, 1938-; assistant pathologist, Cambridge Hospital, Cambridge, Mass., 1940-; pathologist, Lynn Hospital, Lynn, Mass., 1941-. Member: American Medical Association; Massachusetts Medical Society; New England Pathological Society; American Association of Pathologists and Bacteriologists; Boston Branch, International Association of Dental Research. Diplomate: National Board of Medical Examiners; American Board of Pathology.



17
655

UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 43

NUMBER 2



AUGUST 1944

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 172
Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

Only a few months ago men were performing the duties shown in this picture, made in the laboratory of a Naval air station dispensary in the Midwest. Several thousand WAVES are now assigned to shore activities of the Medical Department, laboratory billets being but one of many in which they are making good.

—Official U. S. Navy Photo.

UNITED STATES NAVAL MEDICAL BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

COMPILED AND PUBLISHED UNDER THE AUTHORITY OF
NAVAL APPROPRIATION ACT FOR FISCAL YEAR 1945, PUB-
LIC LAW NO. 347, APPROVED JUNE 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT, ¹
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

Volume 24, 1926, Nos. 1, 2, and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3, and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Prevention of Flash Burns by a Protective Glove Film— <i>Gordon B. Fauley and A. C. Ivy</i>	209
Traumatic Rupture of the Spleen— <i>Gordon M. Perisho and Morris Steiner</i> ..	216
Polycystic Disease of the Kidneys— <i>Samuel S. Leiter and Julius L. Waterman</i>	223
An Ambulatory Program Following Operation for Unruptured Appendicitis— <i>Calvin A. Lauer and Richard K. Kerr</i>	232
Low Back Pain: Subluxations of Apophyseal Joints and Fractures of Articular Facets— <i>Wendell G. Scott</i>	234
Tendon Repair— <i>Thomas C. Cole</i>	241
Reception and Treatment of Casualties Aboard an Assault Transport— <i>Barnes Gillespie and J. Cuthbert Owens</i>	245
Working Rules in the Field; Supplementary Suggestions on Care of Wounded— <i>Emile Holman</i>	253
Genital Manifestations of Early Filariasis— <i>R. Harwood Fogel and Robert W. Huntington, Jr.</i>	263
Acute Infectious Hepatitis— <i>Victor W. Logan</i>	271
Posterior Gonococcal Urethritis— <i>Donald H. Pattison and Robert A. Burhans</i>	278
Treatment of Cerebrospinal Fever with Penicillin; A Preliminary Report— <i>David H. Rosenberg and Philip A. Arling</i>	281
A Spirometer Method for Determining Specific Gravity of Man— <i>Frank J. Gouze and Robert Hayter</i>	288
Toothache in the Low-Pressure Chamber— <i>I. W. Brickman</i>	292
Processing Acrylic Dentures; Compression and Injection Method— <i>Clyde Schuyler, Eduard Georg Friedrich, and Homer C. Vaughan, Jr.</i>	297
Fixed Anterior Acrylic Restorations— <i>Alfred J. Keck and Thomas W. Davin</i>	301
Endotracheal Anesthesia for Dental and Oral Surgery— <i>William B. Johnson, Jr., and Edwin R. Ruzicka</i>	304

	Page
"Trench Mouth" Aboard a United States Naval Auxiliary Vessel— <i>Dion S. Janetos</i>	308
Analysis of Psychiatric Patients Transferred to the United States From an Overseas Base— <i>James N. Williams</i>	311
A Psychometric Procedure for Screening Mental Defectives— <i>Harold M. Hildreth, J. Arthur Wheeler, Jr., and Stanley B. Williams</i>	316
Study of Albuminuria in Applicants for Naval Enlistment— <i>Willis A. Murphy</i>	321
Occupational Therapy in a Naval Hospital— <i>Hardy V. Hughens and Leon O. Parker</i>	325

CLINICAL NOTES

Blastomycosis of the Skin (Gilchrist Type) with Associated Blastomycetic Pulmonary Disease; Report of a Case— <i>Arthur Sayer</i>	333
Closure of Persistent Bronchocutaneous Fistula by Pedicle Muscle Graft; A Case Report— <i>Clifford D. Benson</i>	343
Pes Cavus, Bilateral; A Case Report— <i>Gustave S. Braun</i>	346
Acute Idiopathic Porphyria; Report of a Case— <i>Ferdinand Fetter, Arthur A. Humphrey, and Charles R. Longenecker</i>	349
Penicillin in the Treatment of Empyema Following Lobar Pneumonia— <i>Stephen E. Flynn</i>	353
Case of Sulfonamide Reaction— <i>Dual A. Macintyre, Charles T. Yarrington, Frank S. White, and Byrne W. Mayer</i>	355
Herpes Zoster with Motor Involvement; Report of a Case— <i>G. Bruce Lemmon, Jr.</i>	357
Lingua Nigra; Report of a Case— <i>Raymond D. Little</i>	360

MEDICAL AND SURGICAL DEVICES

An Aid to Foreign Body Localization— <i>Marvin L. Gerber</i>	363
A Flying Suit To Aid in the Control of Hemorrhage— <i>Russell G. Witwer and William F. Leach</i>	366
Dual Diluter Demand Oxygen Regulator— <i>William M. Davidson</i>	368
Simple Treatment for Hemorrhage into the Nail Bed— <i>William J. Schwab and Frank A. Foley</i>	371
Construction of Braces in the Field— <i>John S. Thiemeyer, Jr.</i>	372
A Portable Dental Aspirator— <i>Samstone Holmes and Donald F. McCoy</i>	374
A Universal Two-Litter Lift— <i>Robert C. Willson, George Milles, and Charles N. Muller</i>	376

CONTENTS

VII

EDITORIALS

	Page
Differentiation of Tissues by Means of Filtered Ultraviolet Light.....	379
Early Ambulation of the Surgical Patient.....	380
Flash-Burn Protection.....	381

BOOK NOTICES

Microscopic Technique in Biology and Medicine, <i>Cowdry</i> —A Textbook of Histology, <i>Bremer: rewritten by Weatherford</i> —Elements of Medical Mycology, <i>Swartz</i> —Fractures and Dislocations for Practitioners, <i>Geckeler</i> —The Arthropathes, A Handbook of Roentgen Diagnosis, <i>de Lorimier</i> —Manual of the Diseases of the Eye for Students and General Practitioners, <i>May</i> —An Atlas of Anatomy, Vols. I and II, <i>Grant</i> —Applied Dietetics, <i>Stern</i> —Fundamentals of Chemistry and Applications, <i>Francis and Morse</i>	383
--	-----

PREVENTIVE MEDICINE

Failure of Penicillin to Prevent Syphilis— <i>Cedric C. Carpenter</i>	389
Sulfonamide Ointment in Routine Prophylaxis of Chancroid Disease— <i>Herman S. Zeve and Sol S. Schneierson</i>	391
Prevention of Food Poisoning Epidemics— <i>Gillon M. Cole and Louis Shattuck Baer</i>	393
Carbon Tetrachloride Poisoning.....	396
"Food Poisoning" Due to Cadmium.....	398
NOTES ON OUR RESERVE CONTRIBUTORS.....	401

SPECIAL ARTICLES

PREVENTION OF FLASH BURNS BY A PROTECTIVE GLOVE FILM ¹

GORDON B. FAULEY

Lieutenant Commander (MC) U. S. N. R.

and

A. C. IVY, Ph.D., M.D.

Flash burns are those produced from heat waves of high temperature and brief duration. They result from bomb explosions which are usually accompanied by a high pressure wave, and according to reports such as that of Eckert and Mader,² are commonly of first- and second-degree severity. Ordinary clothing will prevent flash burns to the areas covered.³ Zinc oxide ointment affords some protection against these burns although it possesses physical properties which make it sticky, nondrying, and difficult to remove.

An ideal protective film should be neither irritating nor toxic. It should not crack or peel and should adhere during sweating but be easily removed by washing with soap and water. It should not be sticky, and its color should afford some degree of camouflage. This film must be comfortable to wear, be applicable in both cold and hot climates, and dry rapidly after application. Various mixtures used to prevent flash burns were therefore tested at the Naval Medical Research Institute. The following methods were used.

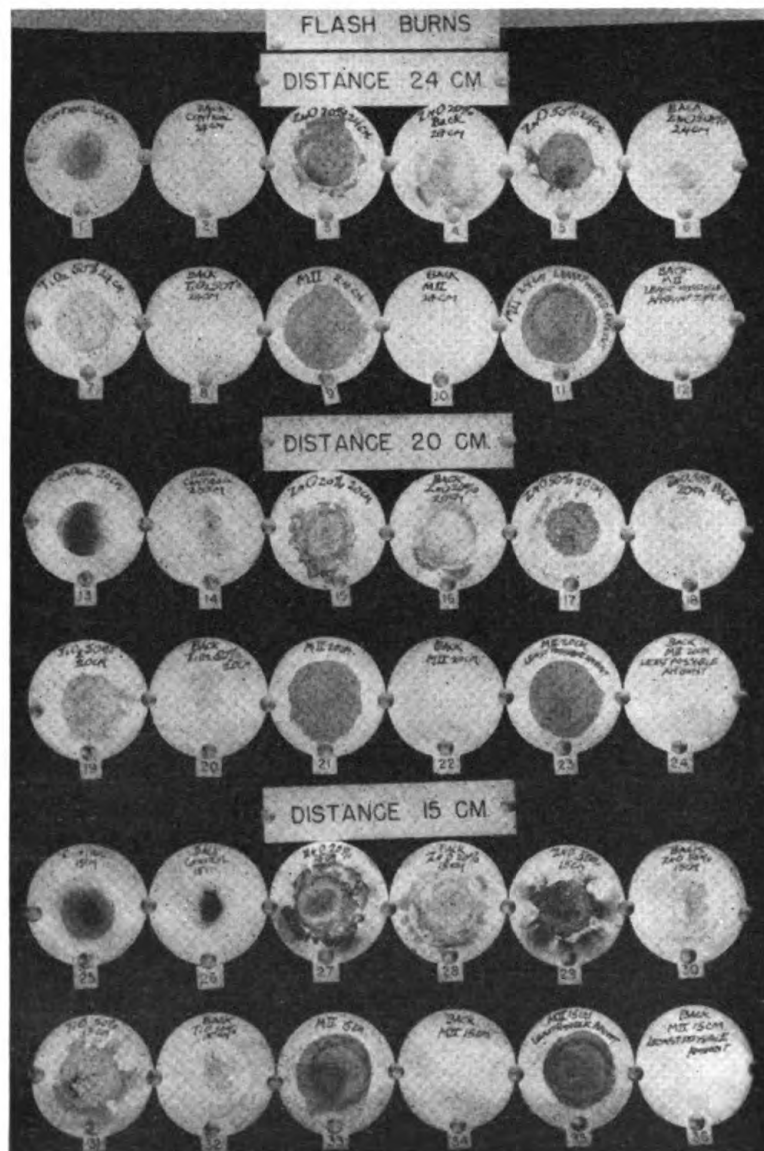
A miniature cannon was first devised for firing a charge of flashlight powder made of magnesium (fig. 2). This "cannon" was turned from solid brass, with the orifice shaped like a funnel. The small end of the funnel was bored to hold the charge of magnesium powder and was ignited by an ordinary spark plug.

After discarding a number of other flashlight powders, magnesium was selected as the standard charge in these trials. The flash from magnesium produces a high temperature of short duration which is accompanied by a high pressure wave. Thus burns similar to actual

¹ U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

² ECKERT, G. A., and MADER, J. W.: "Solace" in action. U. S. Nav. M. Bull. 40: 552-557, July 1942.

³ SAILL, N. T.: Burns en masse. U. S. Nav. M. Bull. 40: 570-576, July 1942.



1. Filter papers which were exposed to the magnesium flashlight powder blast at 24, 20, and 15 cm. The odd numbers are the front and the even the back of the paper.

For example, paper 1 is a control; i. e., it was exposed to flash without being covered with any film; paper 2 is the back of a second paper which was exposed. The back of the paper was slightly scorched at the center, which is not revealed by the photograph. Paper 3 was covered with a film of 20-percent zinc oxide ointment. Note oxidation and dispersion of the ointment and that the back of paper 5 was slightly scorched.

Paper 5 was covered with a film of Ointment I. Note that less dispersion of the film occurred but some scorching of the back, paper 6, resulted. Paper 7 was covered with a film of Ointment II. Note that little oxidation and dispersion and no scorching of the back occurred. Paper 9 was covered with a film of the glove film preparation MII and paper 11 with the thinnest film possible to apply. Note that no dispersion and scorching of the back of the paper resulted.

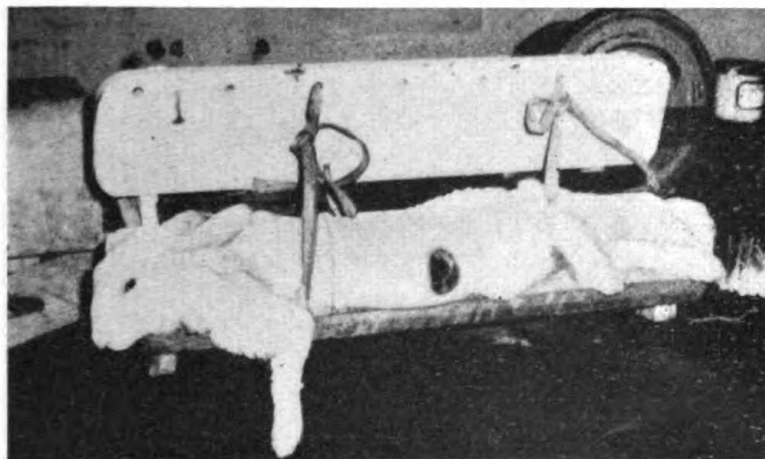
Note that at 20 cm. the 20-percent zinc oxide ointment failed to protect; at 15 cm. the thicker "glove film" paper 33 and 34 protected, and that the thinner "glove film" paper 35 and 36 protected, which occurred only in about 75 percent of cases with the thinner glove film but in all cases with the thicker.

"flash burns" can be produced. One-half gram of magnesium flashlight powder was used for each charge.

The distance of the skin to be burned was set at 24 cm. from the mouth of the "cannon." It is known that a Navy undershirt affords some protection at this distance. Under test conditions the burn is somewhat more severe than that observed in battle. The undershirt is usually scorched and a first-degree burn results. Without protec-



2. The device or "cannon" in which the flashlight powder was ignited.

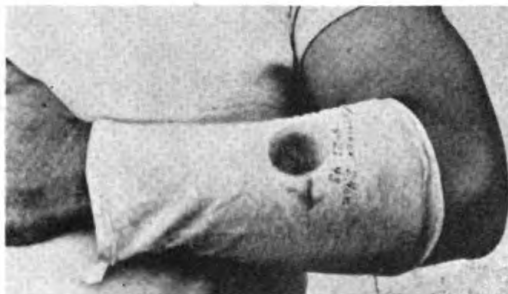


3. Showing an anesthetized rabbit covered with an undershirt and exposed to a magnesium flashlight powder blast at 8 cm. The undershirt is burned and a third-degree burn resulted.

tion, at this distance, the burn produced on an arm was about the size of a half dollar and second degree in nature. The skin blistered and peeled. On about every third trial a third-degree burn was produced and a scab instead of a blister formed.

The temperature at 24 cm. from the mouth of the "cannon" was around $1,000^{\circ}$ to $1,500^{\circ}$ C. At the orifice it was approximately $2,600^{\circ}$ C. These measurements were made with an optical pyrometer by specialists in the Bureau of Standards. It is recognized that no apparatus is now available which permits accurate measurement of a heat wave of such short duration.

All films and ointments were subjected to three consecutive tests. The first was made with a filter paper coated with the substance, and materials that charred the paper were promptly eliminated (fig. 1). The second test was made upon the skin of anesthetized rabbits, in



4. Arm covered by an undershirt and exposed to the flashlight powder blast at a distance of 24 cm.



5. Photograph 24 hours later, of resulting second-degree burn with small areas of third-degree burns.



6. Showing a circular exposed area marked with a pencil; the left half was covered with ointment, and the right half with the glove film and exposed at a distance of 24 cm. A first-, second-, and small areas of a third-degree burn resulted in the left half.

preparation for which the abdomen was shaved and the rabbits were anesthetized by the intravenous injection of nembutal (fig. 3). After

protection was established by tests upon rabbits, the third test was made with the human arm exposed under the standard conditions (figs. 4 to 7).

RESULTS

Five ointments were compared. The first, or standard, contained 20 percent zinc oxide. The next two contained 50 percent zinc oxide but one was colored battleship gray. The last two were made with 50 percent titanium dioxide with one of these mixtures similarly colored gray. Ointments containing 50 percent titanium dioxide were



7. The arm of this subject was covered to the left with ointment and to the right with the glove film. The photograph was taken 5 days after exposure to the flash at 24 cm. and shows a second-degree burn with almost 1 square inch of third-degree burn which occurred under the ointment. The part under the glove film was completely protected.

found to be the most effective. The following proved to be a suitable formula:

	<i>Percent</i>
Titanium dioxide	50
Petrolatum	45
Lanolin, anhydrous	2
Paraffin (125° F.)	2
Mineral black	1

Although the 20 percent ointment of zinc oxide was melted and scattered by the heat of the flash, it did afford some protection. The ointment containing 50 percent zinc oxide was superior to the standard one containing only 20 percent.

The chief advantage of ointments is their resistance to sweating. Their disadvantages are stickiness, failure to dry, and difficulty in removal.

Glove films were studied next because they have proved satisfactory in many industries.⁴ These are constituted so that they dry readily, afford protection, and are easily removed.

In preliminary tests, the following ingredients were eliminated: Metallic aluminum, asbestos powder, and mica powder. All of these tend to irritate wounds. Aluminum affords good protection but it scales and rubs off. It also reflects sunlight and might attract the enemy. Asbestos affords good protection but the coating does not adhere. Mica also offers good protection but cracks readily, is lost easily, and is difficult to apply.

Many trials were made with mixtures containing varying amounts of titanium dioxide, stearates of aluminum, zinc and magnesium, oxides of aluminum, and magnesium. These were tried singly and in various combinations, as were mixtures of titanium dioxide with mica, zinc oxide, and aluminum powder. All of these failed in some degree to satisfy the requirements of smooth appearance, adequate spreading ability and adherence, rapid drying, good insulation, easy removal, and slightly dark color.

A film formula was finally evolved that satisfied the above requirements. It had the following composition:

	<i>Percent</i>
Shellac.....	13.70
Isopropanol (99 percent).....	28.48
Linseed oil (bodied).....	3.50
Stearic acid.....	.15
Flexol.....	.80
Carbitol.....	1.10
Titanium dioxide.....	37.00
Borax.....	2.25
Magnesium stearate.....	8.00
Menthyl salicylate.....	2.50
Duponol.....	.30
Mineral black.....	2.22

This was entitled NMRI-70. It can be manufactured at a cost of about 36 cents per pound. All ingredients are available in adequate amounts.

About 200 tests were made with this film on the arms of 60 different Naval personnel volunteers. Tests for adherence and other qualities were made upon the faces and arms of others in hot, steaming rooms. The formula proved satisfactory.

A comparison between the glove film and ointment of 50 percent titanium dioxide was made by coating one-half of a given skin area with each. The film proved slightly better.

⁴ SCHWARTZ, L.: Protective ointments and industrial cleansers. *M. Clin. North America* 26: 1195-1212, July 1942.

SUMMARY

A technic has been devised for testing mixtures used to prevent flash burns. This consists of a standard size and degree of burn produced by igniting a charge of magnesium powder in a miniature "cannon."

An ointment containing 50 percent titanium dioxide and a glove film with 37 percent titanium dioxide proved effective in preventing flash burns under conditions that are probably as severe as those occurring on board ship.

A glove film may offer more protection than either an undershirt or an ointment. The ointment is superior when profuse sweating occurs, but for most conditions the film is preferable.

No tests under battle conditions have been reported, but materials for trial have been issued.

We acknowledge with gratitude the suggestions made by Dr. Louis Schwartz of the National Institute of Health, the cooperation of the West Disinfecting Company in making most of the creams used in this investigation, the encouragement and advice of Rear Admiral W. L. Mann and Captain E. G. Hakansson (MC) U. S. N., and the services of the numerous hospital corpsmen and WAVES who volunteered as subjects in the experiments.



SULFONAMIDE LESIONS IN RATS

Rats given sulfadiazine, sulfathiazole, sulfanilamide, sulfamerazine, sulfapyrazine, or acetylsulfadiazine in purified diets were studied histologically. The following lesions occurred with some or all of the drugs: depletion of mature granulocytes in the bone marrow with or without an increase in nucleated red cells, necrosis and calcification of skeletal muscle, calcification and hyalinization of pulmonary, coronary, and renal arteries, hydropic degeneration and hyaline necrosis of the liver, necrosis and hemorrhage of the adrenal cortex, hyperplasia of the thyroid, hemorrhage into subcutaneous tissue, body cavities, and various organs, hemosiderosis of spleen, liver, and renal tubules, and renal intratubular sulfonamide deposits with varying degrees of tubular damage.—ENDICOTT, K. M.; KORNBERG, A.; and DAFT, F. S.: Lesions in rats given sulfathiazole, sulfadiazine, sulfanilamide, sulfamerazine, sulfapyrazine, or acetylsulfadiazine in purified diets. Pub. Health Rep. 59: 49-54, January 14, 1944.

TRAUMATIC RUPTURE OF THE SPLEEN

GORDON M. PERISHO

Lieutenant Commander (MC) U. S. N.

and

MORRIS STEINER

Lieutenant Commander (MC) U. S. N. R.

Traumatic rupture of the spleen is a dramatic and grave calamity, the fatality rate of untreated cases having been reported to vary from 90 to 100 percent. The latter figure is more probably correct, since McCartney (1) in a review of 25,000 consecutive autopsies found no instances of healed splenic injuries. Bell (2) was unable to recall any instance of autopsy findings indicating spontaneous recovery from a traumatic rupture of the spleen.

Present day methods of warfare, involving the use of high speed vehicles of all types, tanks, jeeps, mobile artillery, and airplanes, greatly increase the opportunities for sudden application of forces to the body conducive to rupture of the spleen. Prompt diagnosis and early surgical intervention with splenectomy offers an excellent chance for recovery, whereas failure to recognize the condition is practically invariably fatal.

The classic picture of ruptured spleen is familiar, i. e., shock, air hunger, rapid pulse, dullness and rigidity in the left upper abdomen, pain referred to the left shoulder (Kehr's sign) and laboratory evidence of secondary anemia. It must be emphasized, however, that to wait for this fully developed clinical picture before making the diagnosis is to invite death from hemorrhage before operative intervention can be attempted. Traumatic rupture of the spleen can be exceedingly insidious in its onset, and even in the presence of gross rupture the symptoms and signs may be slight, until abruptly and with alarming rapidity the patient collapses.

A knowledge of the variety of pathologic changes that can occur in traumatic rupture of the spleen is of utmost importance as an aid in the diagnosis of the "atypical" case.

The most frequent sequence of events is a history of a blow on the left side of the lower thorax, back or abdomen, which produces a complete laceration of the spleen through the capsule, with rapid continuous hemorrhage into the peritoneal cavity. The patient gradually but progressively goes into collapse, with all of its attendant classic signs and symptoms.

A less common, but more dangerous chain of events is the so-called delayed or secondary hemorrhage from splenic injury. This entity is receiving the widespread recognition it deserves as the result of the contributions of McIndoe (3) who in 1932 collected and reviewed 46 cases of secondary hemorrhage following injury to the spleen. Bueermann (4) reported 2 cases of traumatic rupture of the spleen with delayed hemorrhage and gave a comprehensive summary of the clinical and pathologic findings in this condition. In July 1943 Waugh and Prior (5) reviewed the literature and found 68 reported cases. They added 2 of their own. Doubtless many other cases have occurred, but have not been reported. One of the authors recalls one such case occurring in 1937, 4 days after injury.

The changes which occur in delayed hemorrhage are of 3 types: (1) A minor, superficial capsular rupture with ecchymosis and slight bleeding; (2) an intrasplenic hematoma and subcapsular bleeding, with subsequent rupture of the capsule and rapid intraperitoneal hemorrhage; and (3) a parenchymal and capsular rupture with slow initial bleeding and subsequent rapid free hemorrhage.

In the 70 cases reviewed by Waugh and Prior the time interval between the injury and the onset of clinical signs of hemorrhage ranged from 48 hours to as late as 6 months, the majority having a latent or silent period of 3 to 6 days. The onset of the delayed hemorrhage is usually very abrupt, and is rapidly followed by an alarming degree of collapse, shock, and all the other classic symptoms of primary hemorrhage. Its danger lies in the fact that it is usually not anticipated, and before operative intervention can be arranged and attempted, fatal hemorrhage has occurred.

Since the treatment is always surgical, splenectomy being the operation of choice, the problem is to make the diagnosis and operate before exsanguinating hemorrhage occurs.

Probably the most important aid in diagnosis is to have this possibility in mind, considering every patient who has received a contusion to his left lower thorax, back or upper abdomen, a possible case of delayed splenic hemorrhage, and to place him under close observation.

It is important to emphasize that there are many deceiving features about the signs and symptoms of intraperitoneal hemorrhage (6). Hemorrhage into the peritoneal cavity is not commonly seen by physicians in civilian life, except by gynecologists. Most physicians have the misconception that free blood in the peritoneal cavity is a marked peritoneal irritant, causing severe abdominal pain, tenderness, and splinting of the muscles of the abdominal wall. The sharp severe pain of a rupturing ectopic pregnancy is not the pain of blood running into the peritoneal cavity, but the pain of the stretching and

tearing of the peritoneum of the broad ligament. Hemoperitoneum may be extraordinarily silent. When blood is poured into the peritoneal cavity it acts as only a very mild irritant and in itself produces little or no pain. The patient may have a feeling of uneasiness in the abdomen, but little else. Referred pain to the left shoulder (Kehr's sign) has already been mentioned as a valuable indication of intraperitoneal hemorrhage.

Another deceptive feature is the common fallacy that bleeding into the peritoneal cavity produces rapid feeble pulse. It can do so, but frequently the pulse rate, even in the presence of considerable bleeding, stays within normal limits for a long time, and then quite suddenly rises to 120 or 140 beats per minute.

Few physicians are aware of the assistance that x-ray studies can give in diagnosing ruptured spleen. A review of several recent articles on ruptured spleen with both immediate and delayed hemorrhage failed to reveal any mention of x-ray diagnosis in this condition. Standard surgical textbooks fail to mention x-ray studies in the diagnosis of ruptured spleen. In only 3 instances was x-ray examination discussed or mentioned. Deaver (7) reported a case of ruptured spleen in which the roentgenologic finding of an elevated left diaphragm was noted and interpreted as being due to displacement by the hemorrhagic mass in the left upper quadrant of the abdomen. Solis-Cohen and Levine (8) published 2 cases of traumatic rupture of the spleen in which they described changes on the flat plate of the abdomen that they considered diagnostic. Waugh and Prior stated that x-ray evidence of a fracture of the eleventh and twelfth ribs on the left side should suggest the possibility of trauma to the spleen.

What are the roentgenologic findings that might aid in the diagnosis of traumatic rupture of the spleen? They are based on the anatomico-pathologic changes that occur in this condition. The normal spleen can usually be visualized on a technically satisfactory flat film of the upper abdomen such as is used in studying the kidneys and ureters. It is usually separate and distinct from the shadow outlining the left kidney. From a technical standpoint, the addition of 3 to 5 mm. aluminum filter to the x-ray tube port will often increase soft tissue definition.

The indirect findings suggesting ruptured spleen have already been mentioned. They are elevation of the left diaphragm and fractures of the left lower ribs.

In the event of delayed or secondary hemorrhage from trauma to the spleen, as long as the capsule of the spleen remains intact the only change demonstrable by x-ray would be an abnormal enlargement of the spleen shadow. Since the normal spleen is capable of consid-

erable variation in size, as has recently been demonstrated by Wu (9) one would hesitate to make a dogmatic statement that in a given case the spleen shadow had exceeded normal limits in size. However, when the capsule is lacerated and a perisplenic hematoma or clot is present, certain changes occur that are susceptible of interpretation by x-ray.

The perisplenic mass disturbs the normal relationship and location of adjoining structures. The stomach, which usually contains sufficient gas to be identified, will be displaced toward the right, and there will be a well-defined concave indentation on its greater curvature side. Abdominal trauma usually causes a reflex ileus, which makes identification of the gas-filled hollow viscus structures possible. Thus the colon can be seen and in the presence of a perisplenic mass, the splenic flexure and left half of the transverse colon will be displaced downward. The space normally occupied by these displaced structures will be filled by a homogeneous soft tissue mass not normally seen in the upper quadrant of the abdomen.

In the following case traumatic rupture of the spleen with delayed hemorrhage was suspected. Additional confirmation of this diagnosis was contributed by roentgenologic examination.

Case report.—An 11-year-old white boy was admitted to this hospital at 2100 on 28 May 1943 with the history of having fallen flat on his abdomen at about 1900. He stated that he had "the wind knocked out of him" but was able after a short time to get up and walk home. He complained of pain in his upper abdomen and was brought into the clinic for examination. His past history and family history were essentially negative.

Examination revealed him to be not acutely ill and not complaining of subjective pain; his color was good, respiration normal, and pulse 78. His blood pressure was 90/45. The abdomen was obese and not distended. There was tenderness on pressure in the midepigastrium and in the left upper abdominal quadrant. The patient complained of pain in the left shoulder on deep palpation in the splenic area. Other physical findings were normal.

Blood examination revealed the following: White blood cells 7,100 per cu. mm. with 72 percent segmented neutrophils, 6 percent band forms, 3 percent juveniles, 2 percent monocytes and 17 percent lymphocytes. The red blood cell count was 3,140,000; hemoglobin was 10 gm. The urinalysis was negative.

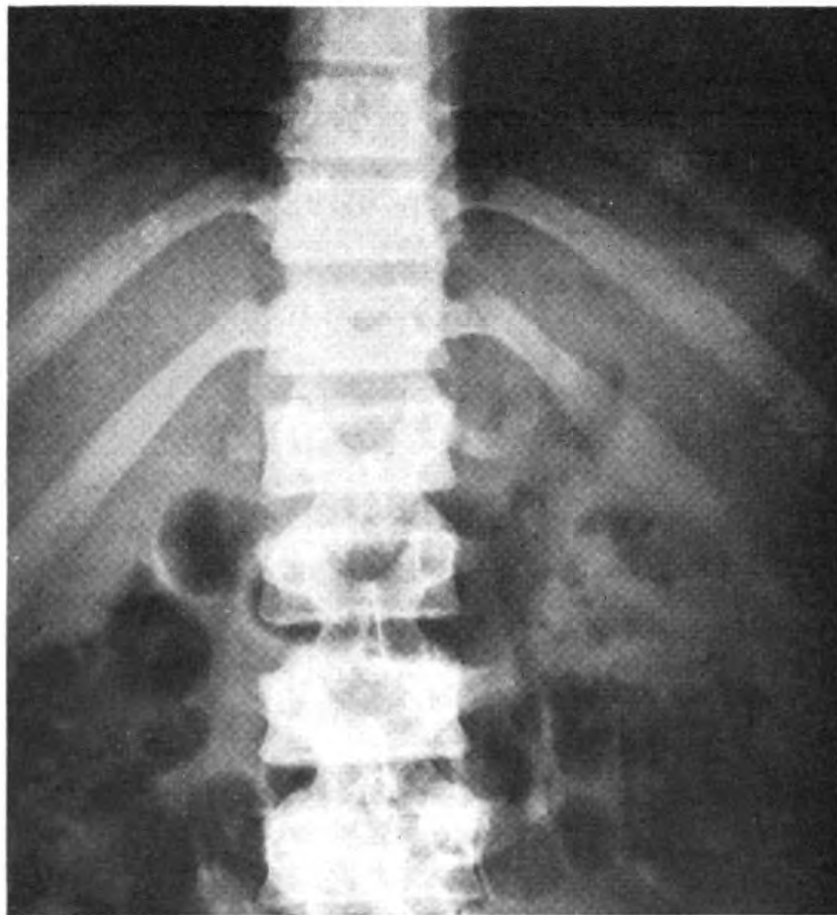
A tentative diagnosis of traumatic rupture of the spleen with delayed hemorrhage was made. Operation was deferred for further observation of the patient because of the normal pulse and blood pressure and absence of signs of intraperitoneal bleeding. Pulse and blood pressure were taken every hour. The patient was typed, and a donor secured and cross matched for immediate use.

The patient had an uneventful night and when seen the next morning complained of feeling hungry and was reading a comic strip. His pulse and blood pressure had not varied during the night. Examination of his abdomen revealed more diffuse tenderness and at this time peritoneal rebound tenderness was present.

A flat plate of the abdomen was taken and showed a homogeneous shadow of increased density in the left upper quadrant obscuring the normal splenic outline. The stomach and colon contained sufficient gas to be well outlined

and the splenic flexure of the colon was displaced downward below its normal position. The ascending portion of the greater curvature of the stomach appeared to be displaced toward the right, and there was a smooth concave indentation of the greater curvature suggesting extrinsic pressure from a mass in the left upper quadrant of the abdomen. These findings were compatible with a diagnosis of ruptured spleen with a perisplenic hematoma displacing the stomach and colon downward to the right (fig. 1).

The patient was immediately prepared for operation. A left upper rectus muscle-splitting incision was made. The spleen was found to be ruptured

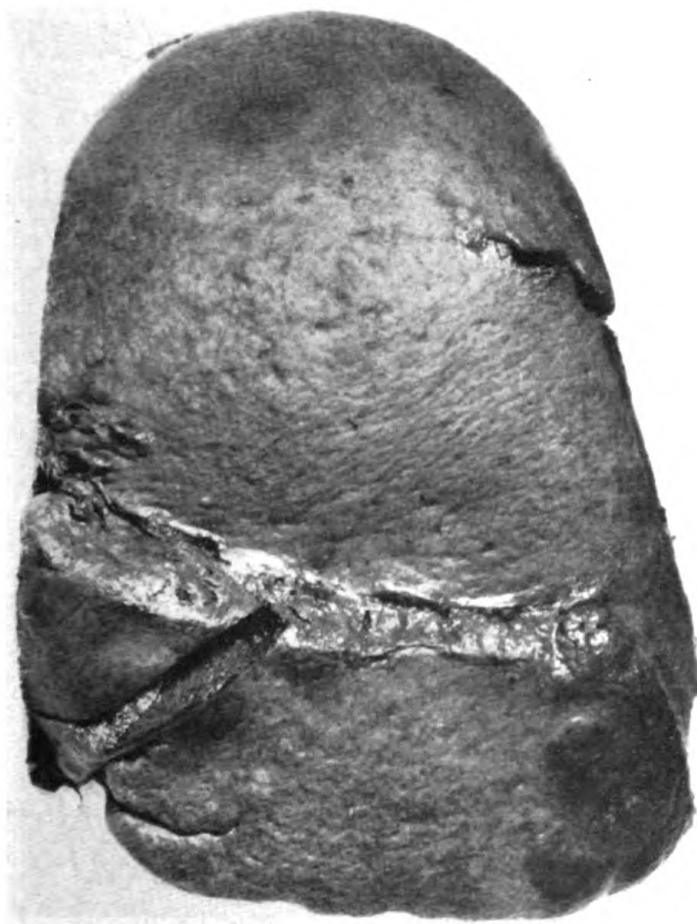


1. Flat plate of abdomen showing homogeneous mass in left upper quadrant obscuring the normal spleen shadow; displacement of the splenic flexure downward; displacement of the ascending portion of the greater curvature of the stomach toward the right with smooth concave indentation, suggesting extrinsic pressure from a mass in the left upper quadrant.

and there were some clots and about 300 cc. of fresh blood present. The gastrosplenic and phrenic ligaments were cut, the spleen was mobilized, the pedicle clamped, cut, and the stump tied with catgut. A transfusion of 500 cc. of whole blood was given in the operating room. The postoperative course was uneventful.

The pathologic examination showed that the specimen weighed about 177 gm., which is twice the normal size of that of a child of this age. There was a transverse line of rupture extending completely around the spleen, lying parallel

to the lower border at a point two-thirds the distance to the upper pole (fig. 2). There was a second rupture along the posterior border one-third the distance to the upper pole. There were a number of hemorrhagic areas below the large rupture. Microscopic section showed extensive hemorrhage which was apparently traumatic in origin.



2. Specimen of spleen removed at operation, showing transverse line of rupture extending completely around the organ and small second rupture along the posterior border.

SUMMARY

1. Traumatic rupture of the spleen with delayed hemorrhage may exist in a patient without any manifest clinical symptoms or signs.
2. Roentgenologic study (flat plate of the abdomen) may lend considerable assistance in establishing this diagnosis.
3. The roentgenologic findings to be looked for are obliteration of the normal spleen shadow, the presence of a homogeneous soft tissue mass in the left upper quadrant of the abdomen, displacement of the stomach to the right and concave indentation on its greater curvature, and displacement downward of the splenic flexure and the left half of the

transverse colon. The indirect findings suggesting ruptured spleen are elevation of the left diaphragm and fractures of the left lower ribs

REFERENCES

1. MCCARTNEY, J. S.: Quoted by WEBB, R. C.: Traumatic rupture of normal spleen with delayed hemorrhage. *Journal-Lancet* 59: 545-547, December 1939.
2. BELL, E. T.: Quoted by WEBB, R. C.: Traumatic rupture of normal spleen with delayed hemorrhage. *Journal-Lancet* 59: 545-547, December 1939.
3. McINDOE, A. H.: Delayed hemorrhage following traumatic rupture of spleen. *Brit. J. Surg.* 20: 249-268, October 1932.
4. BUEEBMANN, W. H.: Latent period and delayed hemorrhage following traumatic rupture of spleen. *U. S. Nav. M. Bull.* 41: 73-93, January 1943.
5. WAUGH, R. L., and PRIOR, J. A.: Traumatic rupture of spleen with delayed hemorrhage, with reference to condition as complication of rib fractures; report of 2 cases. *Surgery* 14: 125-133, July 1943.
6. STABLER, F.: Complications of abdominal wounds; immediate. *J. Roy. Nav. M. Serv.* 29: 22-29, January 1943.
7. DEEVER, J. M.: Delayed hemorrhage following traumatic rupture of spleen—with particular reference to roentgenologic findings; case report. *Ann. Surg.* 113: 477-480, March 1941.
8. SOLIS-COHEN, L., and LEVINE, S.: Roentgen diagnosis of lacerated spleen. *Radiology* 39: 707-710, December 1942.
9. WU, P. P. T.: Maximal volume of human spleen. *Surg., Gynec. & Obst.* 77: 74-78, July 1943.



IS FEVER BENEFICIAL?

It is often said that fever assists the host in combating infection. There is no question of the value of fever in neurosyphilis and in certain other types of infection, such as those due to the gonococcus. On theoretical grounds we know that elevated temperature accelerates antibody formation, and that the increased viscosity of the blood plasma which accompanies fever enhances its agglutinating action. Moreover, some bacteria and spirilla suffer attenuation of virulence at febrile temperatures. Certainly it is true that failure to develop fever in response to a severe infection usually signifies a grave prognosis. On the other hand, it is probably fair to say that the presence or absence of fever has little influence on the course of many infectious diseases.

The fever which accompanies noninfectious conditions does not appear to serve any useful purpose, and may at times be harmful. In malignant disease, for instance, high temperature only accelerates weight loss and causes malaise. The fever which follows myocardial infarction increases the metabolic rate, thereby placing an extra load on the weakened myocardium. The hyperpyrexia of heat stroke may cause death. It appears, therefore, that fever is decidedly beneficial in certain infections and is possibly beneficial in some others, but that in noninfectious diseases it may actually be harmful.—BEESON, P. B.: Fever. *Clinics* 2: 1361-1393, April 1944.

POLYCYSTIC DISEASE OF THE KIDNEYS

SAMUEL S. LEITER

Lieutenant, junior grade (MC) U. S. N.

and

JULIUS L. WATERMAN

Captain (MC) U. S. N. R.

Polycystic disease of the kidneys is an uncommon condition yet it occurs often enough to be of some clinical importance. As a rule it is not seen in the younger age group such as those who make up the great majority of our present Naval personnel, but with the influx of older men into the Naval service there is a likelihood that more examples of this condition will be found. Its occurrence in a 30-year-old aviation machinist's mate, third class, whose history is one of those reported here, is a case in point.

At the Philadelphia Naval Hospital, where about 40 percent of the patients have been veterans of either the Spanish-American War or of World War I, a much larger number of cases is seen than at most other Naval medical activities. During the year 1943, with 14,467 admissions, 5 cases of polycystic kidney disease were seen, three of which came to autopsy. In contrast, during the years 1930-1935 only 5 cases were seen at the Harlem Hospital although admissions totaled 67,000. Braasch and Schacht (1) reported a necropsy ratio of 1 in 1,019. Rathbun's (2) autopsy percentage has been 5.63 cases per 1,000 necropsies, whereas ours has been 8.5 per 1,000 (3 in 352 necropsies).

Polycystic disease of the kidneys is always congenital, almost always bilateral, and has a decided familial and hereditary tendency which may be transmitted through either sex. Gordon and Trasoff (3) reported its occurrence in 9 members of one family. Cairns (4) has also stressed its familial tendencies. We have been able to establish it as the cause of death in a sister and a brother of one of the patients whose case is reported here. It was possibly also the cause of death of their mother, although this could not be established definitely.

In polycystic kidneys the renal parenchyma is almost entirely obliterated and replaced by hundreds of projecting cysts of varying size and color. These cysts are usually filled with clear yellowish fluid but may contain fluid that is cloudy or hemorrhagic, thus imparting to the kidney all the colors of the rainbow. The kidney is usually

two or three times normal size and retains its approximate original shape (fig. 1).

On cut section the parenchyma remaining between the cysts is seen to be compressed and even totally destroyed. A typical kidney show-



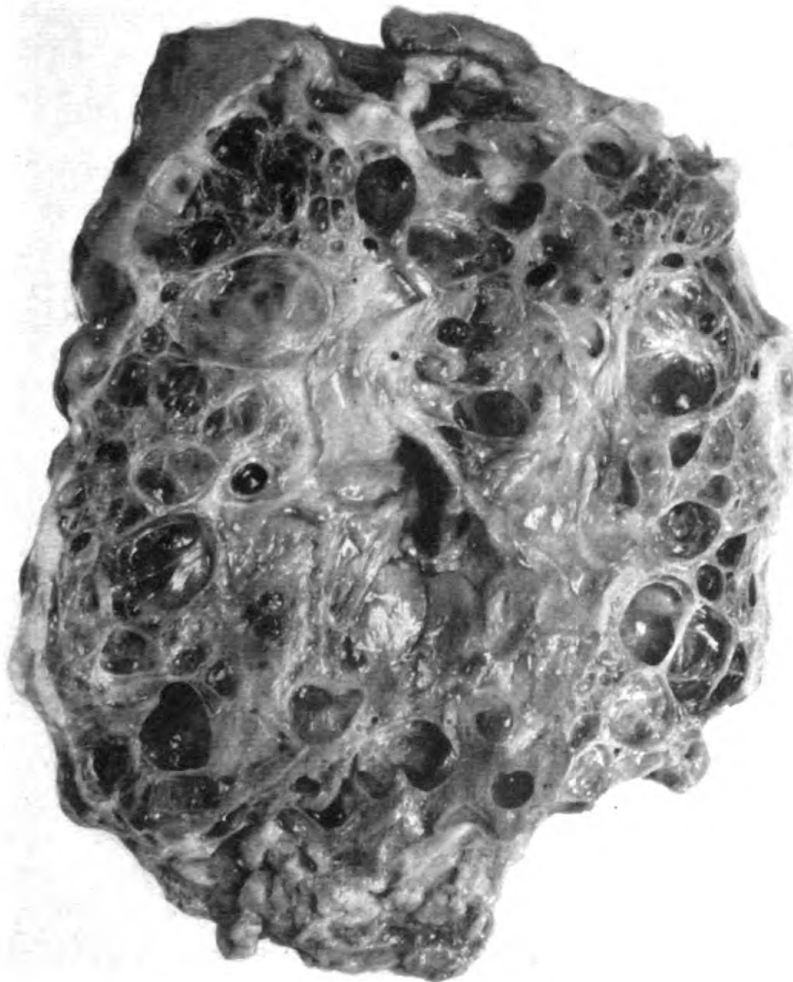
1. External surface of a typical polycystic kidney.

ing this amazing arrangement is shown in figure 2. On microscopic examination what little functioning parenchyma remains is seen to be compressed between the numerous thin-walled, smooth-lined cysts.

The cause of polycystic disease of the kidney is to be found in renal genesis. Its exact embryologic basis has never been satisfactorily

explained and controversial statements may still be found in the literature. It had long been thought that it resulted from nonunion of the embryonic convoluted tubules with the collecting tubules, resulting in retention cysts.

Kampmeier (5) has shown that as the primitive outgrowths



2. Typical polycystic kidney cut to show the almost complete loss of renal parenchyma.

from the renal pelvis divide repeatedly to form collecting ducts, each becomes united with a primitive tubule. The first 3 or 4 generations of convoluted tubules are not permanent but become detached from the collecting tubules and persist for a time as cystic structures, usually provided with a glomerulus. Normally these cystic

ducts atrophy and their persistence offers the simplest explanation for the origin of this disease. These cysts are thought to increase in size but not in number, and so, slowly but surely, produce the condition we know as polycystic disease of the kidneys.

Roos (6) in a recent publication has stated that the cause may be found in the fact that a developmental anomaly is responsible for the nonfusion of glomeruli and tubules with the result that the glomeruli become distended by the secretion from their own tufts. Norris and Herman (7) state that polycystic disease of the kidneys is an abnormal extension of the degenerative process occurring normally in the mesonephros and in the first generations of nephrons in the metanephros.

Whatever the true etiology may be, we do know that it is a slowly progressive disease, and for that reason the body economy is able to adjust itself to the steadily increasing retention of nitrogenous waste products. This adjustment enables the patients to carry on in a perfectly normal manner with remarkable blood elevations of these products.

Clinically two forms of this condition are recognized. One form is seen in the newborn and usually, if sufficiently extensive, results in death either in utero or shortly after birth. The kidneys are often so large as to interfere seriously with the infant's delivery. If the disease exists only to a mild degree, however, it is thought that the child lives a more or less uneventful childhood and young adulthood only to develop the disease in later life with the clinical picture and renal pathologic changes previously described.

Rathbun has recently presented evidence supporting the theory that the condition as seen in the newborn is not the same as that found in adults. He believes that the polycystic kidney of the newborn differs from the polycystic kidney of the adult both grossly and microscopically. Whereas the adult polycystic kidney on section presents a honeycombed appearance, the polycystic kidney of the newborn looks like a piece of sponge rubber. Microscopically the adult kidney has some fairly normal parenchyma compressed between the cysts, while in the newborn polycystic kidney one sees a great increase of interstitial fibrous tissue with an occasional grossly deformed tubule or glomerulus scattered through it. Bell (8) has also reported the microscopic dissimilarity between these two types of polycystic kidneys.

O'Crowley and Martland (9) stress the frequent occurrence of spontaneous subarachnoid hemorrhages in polycystic kidney disease due to rupture of congenital "berry" aneurysms of the vessels at the base of the brain. Rathbun in his series of 17 cases lists the occurrence of numerous congenital defects, among which are congenital cystic liver, absence of left kidney and testicle, congenital deformity of anal orifice,

occipital meningocele, absence of anus, and other conditions.

Often this disease manifests itself as a "general rundown condition," the patient being unable to give any good reason for his illness. It is occasionally the cause of death in previously "healthy" persons. One of us (J. L. W.) recalls the case of a practicing physician who was cognizant of the fact that he had polycystic kidneys but who found them no great detriment in carrying on an active practice. One day he was found on the highway where he had died while changing a tire on his car. Autopsy revealed no lesion except bilateral polycystic kidney disease, far advanced.

All too often the symptoms are vague, as in one of the cases reported here, but usually they resemble those of chronic nephritis with albuminuria, lumbar pain, pyuria, hematuria, etc. Hematuria is an outstanding symptom and is usually painless, persistent, and irregular, simulating renal neoplasm. In polycystic kidney disease, however, the masses in the kidney region are usually bilateral, the blood urea nitrogen is elevated, and tests reveal markedly impaired renal function, thus helping to distinguish this condition from renal new growths. The presence of bilateral masses serves also to assist in differentiating it from chronic nephritis. The x-ray is valuable in arriving at a diagnosis. If the condition is advanced enough to give symptoms, the x-ray findings are usually quite typical. The picture is that of "dragon deformity," i. e., the deformity of the calices caused by pressure of the multiple cysts resulting in bizarre flattening and rounding (fig. 3).

At times the outlines of various cysts may be seen. The x-ray evidence must be differentiated from the elongation and pressure deformities seen in the calices of kidneys with renal neoplasms and solitary cysts, but these are usually unilateral. Occasionally a flat film of the abdomen may show bilateral soft tissue shadows more or less characteristic of polycystic kidney disease.

CASE REPORTS

Case 1.—A 30-year-old aviation machinist's mate, third class, well developed and moderately obese, was admitted with the chief complaint of pain in the right upper quadrant of the abdomen. He was assigned to the gastro-intestinal service with the diagnosis of "DU (cholecystitis)." He had apparently been in good health until 4 days previously when, while aboard ship, he experienced a sudden sharp pain in the right lower quadrant of his abdomen which radiated to the flank and to the right upper quadrant. At that time he felt nauseated but did not vomit. Extreme tenderness to palpation in the area of the gallbladder caused the ship's medical officer to consider gallstone colic the most likely diagnosis. A hypodermic injection gave him immediate and marked relief. Since the occurrence of the pain he had had a low-grade fever (100° F.) and he was able to eat all types of food without discomfort. His urine had been darker than usual at the time of the attack and for some time thereafter.

A review of all systems failed to reveal any significant abnormalities. The patient's past medical history was irrelevant. His family history was interesting

in that his mother had died at the age of 41 from "kidney trouble." His father and sister were living and well. On physical examination upon entrance to this activity he was not tender in any area and no masses were palpable in the abdomen.

A flat plate roentgenogram revealed two opacities outside the gallbladder and



3. Retrograde pyelogram illustrating the typical picture of advanced polycystic kidney disease.

probably within the renal pelvis on the right side. Oral cholecystography demonstrated a normally functioning gallbladder. He was transferred to the urologic service where a retrograde pyelogram and an intravenous urogram were done revealing the typical pyelographic findings of polycystic kidneys in addition to the renal calculi. Accordingly he was brought before a board of medical survey

which recommended that he be discharged from the Naval service. During his short stay at this activity his blood pressure fluctuated from 126/108 to 160/130. The blood urea nitrogen determination 12 days after admission was 16 milligrams percent, and the phenolsulfonphthalein test revealed a reduction in renal function estimated at about 25 percent in 2 hours.

Case 2.—A 48-year-old veteran of World War I was admitted with the chief complaints of backache, easy fatigability, nocturnal leg pains, and nocturia of 3 or 4 times. He considered himself in good health except for his backache which began about 6 years prior to his admission and which had gradually become worse.

On admission he appeared to be a healthy middle-aged white male who was well nourished, alert, and without much complaint. His blood pressure was 160/100. Palpable masses that moved on deep inspiration were present in both upper quadrants of the abdomen. His blood urea nitrogen was found to be 130 milligrams percent, while his urine was negative except for a trace of albumin. A phenolsulfonphthalein test revealed no excretion of dye within 2 hours. Cystoscopy disclosed cystitis cystica, verified by biopsy, and retrograde pyelograms revealed typical findings of bilateral polycystic kidney disease.

His family history was interesting in that his mother, a sister, and a brother all died from some form of "kidney trouble." Investigation disclosed that the sister and brother died due to rupture of polycystic kidney proved by autopsy. No records could be obtained on the mother but we strongly suspect that she also died of the same disease.

COMMENT

Case 2 emphasizes certain points. First, the paucity of symptoms that may exist when the disease is far advanced; second, that symptoms may be delayed until early middle life; and third, the distinct familial tendency.

Treatment has always been a problem and is generally most conservative. Usually the urologist turns the patient over to the internist for management since the disease is primarily a medical problem. Rathbun, however, believes that the urologist can do much for the patient with polycystic kidneys and he holds a more optimistic view regarding this condition than do most writers. Nephrectomy is almost always contraindicated, except in cases of persistent suppuration or bleeding from one kidney, since the patient can ill afford to lose any functioning renal tissue. When pressure causes unbearable pain the superficial cysts may be evacuated by the method of Rovsing (10). The Rovsing operation has been found to be a useful procedure by Herman (11). Rathbun views it as a lifesaving measure.

Cabot (12) logically admonishes that since this condition is almost always bilateral, only the most conservative urologic and medical treatment is usually indicated. In proved unilateral cases nephrectomy may be considered, but it is not advisable except as a "last hope" measure when the proper indications exist, for there is no guarantee that the remaining kidney may not subsequently become cystic. Rathbun reports that in one of his cases one-half of a horseshoe kidney

was polycystic while the other half was perfectly normal. Braasch and Schacht consider that polycystic kidney disease is always bilateral, and that if one kidney is not cystic when first seen, the "normal" kidney will sooner or later become so.

SUMMARY AND CONCLUSIONS

1. A summary of the cases of polycystic kidney disease appearing on the urologic service at the Philadelphia Naval Hospital during the year 1943 is presented. Two cases of the disease with widely varying clinical pictures are reported.

2. Polycystic disease of the kidneys is a congenital condition, either fatal in early infancy, or slowly progressing to cause death in middle or late adult life. The condition is usually asymptomatic during childhood and early adult life.

3. The condition has a strong possibility of being familial and hereditary in character.

4. Symptoms may be vague and point to other organs, the diagnosis being made only after roentgenographic study of the urinary tract.

5. Treatment is palliative and should be directed toward prolonging life as comfortably as possible.

6. This condition may easily be missed in the recruiting office examination. Careful examination of the abdomen for nodular masses in the kidney region should be made of all candidates with a familial history of "kidney trouble." Candidates with even slightly elevated blood pressures should receive the same careful examination, although an elevated blood pressure is not always a finding in this disease. Persons with "latent" polycystic kidney disease are not good risks for active service, and should in fact be discharged. Much time and expense will be avoided if the condition can be demonstrated before entrance into the service.

REFERENCES

1. BRAASCH, W. F., and SCHACHT, F. W.: Pathological and clinical data concerning polycystic kidney. *Surg., Gynec. & Obst.* 57: 467-475, October 1933.
2. RATHBUN, N. P.: Random thoughts of polycystic disease of kidneys. *Tr. Am. A. Genito-Urin. Surgeons* (1942) 35: 131-145, 1943.
3. GORDON, G. R., and TRASOFF, A.: Congenital polycystic kidney, with report of its occurrence in several members of one family. *Am. J. M. Sc.* 194: 112-117, July 1937.
4. CAIRNS, H. W. B.: Heredity in polycystic disease of kidneys. *Quart. J. Med.* 18: 359-392, July 1925.
5. KAMPMEIER, O. F.: Hitherto unrecognized mode of origin of congenital renal cysts. *Surg., Gynec. & Obst.* 36: 208-216, February 1923.
6. ROOS, A.: Polycystic kidney; report of case studied by reconstruction. *Am. J. Dis. Child.* 61: 116-127, January 1941.
7. NORRIS, R. F., and HERMAN, L.: Pathogenesis of polycystic kidneys; reconstruction of cystic elements in 4 cases. *J. Urol.* 46: 147-176, August 1941.

8. BELL, E. T.: Cystic disease of kidneys. *Am. J. Path.* 11: 373-418, May 1935.
9. O'CROWLEY, C. R., and MARTLAND, H. S.: Association of polycystic disease of kidneys with congenital aneurysms of cerebral arteries. *Am. J. Surg.* 43: 3-9, January 1939.
10. ROVSING, T.: Treatment of multilocular kidney cystoma (congenital cystic kidney) by means of multiple punctures. *Am. J. Urol.* 8: 120-124, March 1912.
11. HERMAN, L.: *The Practice of Urology*. W. B. Saunders Co., Philadelphia, 1938.
12. CABOT, H.: *Modern Urology*. 3d edition. Lea & Febiger, Philadelphia, 1936. vol. I, p. 209.



HYPERINSULINISM AND RHEUMATIC FEVER

Attention is called to the fact that diabetes (hypoinsulinism) and rheumatic fever seldom co-exist. Evidence is cited that allergic disorders are characterized by hyperinsulinism. Since rheumatic fever is a variety of bacterial allergy, it was postulated that rheumatic subjects should also have hyperinsulinism. Glucose tolerance tests in 11 patients having rheumatic fever disclosed that such was the case. Dietary treatment of the endocrine abnormality with resultant normalizing of the blood-sugar curves resulted in freedom from further rheumatic attacks.—ABRAHAMSON, E. M.: Hyperinsulinism as etiologic factor in acute rheumatic fever. *J. Clin. Endocrinol.* 4: 71-74, February 1944.



DEATH FROM PENTOTHAL ANESTHESIA

On analysis of 7,500 case samples of anesthesia, the death rate attributable to pentothal was found to be six times higher than the death rate from all other anesthetic agents combined. This emphasizes the importance of its consideration and probably indicates the unwise use of pentothal rather than its inadequacy for military purposes. The advantages associated with the use of pentothal as an anesthetic agent have been so impressive that its dangers and disadvantages have been overlooked or have not been fully realized.—News and comment: Pentothal anesthesia. *Bull. U. S. Army M. Dept.* No. 76, 1-3, May 1944.

AN AMBULATORY PROGRAM FOLLOWING OPERATION FOR UNRUPTURED APPENDICITIS

CALVIN A. LAUER

Lieutenant Commander (MC) U. S. N. R.

and

RICHARD K. KERR

Lieutenant Commander (MC) U. S. N. R.

At this station, where the physical fitness program is paramount, an ambulatory program was carried out with 46 appendiceal postoperative patients who were returned early to active duty. No complications were encountered and sick days were reduced to a minimum. Physical strength, morale, and interest in the program were maintained at a high level.

The pathologic findings at operation in this group varied from mild inflammation to phlegmonous and gangrenous changes, but no perforations were encountered. Routine operative procedures were followed to the extent that the individual case would permit. Procaine spinal anesthesia and oxygen occasionally supplemented with intravenous pentothal sodium was used.

The McBurney incision was exclusively used, although in 3 cases Fowler-Weir extensions were added to permit more adequate exposure. One of the authors has used this extension in 30 difficult cases during the past 7 years and has found it highly satisfactory in establishing good exposure.

Regular commercial twisted white cotton was employed for ligatures and interrupted sutures. No. 60 was used for fine ties, No. 40 for heavier ligatures and peritoneal and muscle sutures, and No. 30 for the fascia of the external oblique muscle. When black cotton was used for skin sutures, slight redness was observed about the sutures. This was eliminated when undyed cotton was substituted.

For 8 hours postoperatively a horizontal position with head flat was maintained and deep breathing encouraged. Food and fluids by mouth were withheld until good peristalsis was audible by stethoscope, which was usually 12 to 24 hours after operation. Following this plan no postoperative distention was encountered. Six ounces tap water rectal retention instillation was given every 4 hours, and for the dehydrated patient dextrose intravenously was given.

With the exception of the patients that required an extension to

their McBurney incisions, all were ordered out of bed 8 to 12 hours after operation. On first getting out of bed they were permitted to push a light chair about the room to give them a feeling of security. Following this they were made ambulatory and were allowed up and about at will. Fifty percent were attending classes by the third day. Stitches were removed and the patients discharged on the fifth day. On the fourteenth postoperative day, daily noncompetitive swimming was commenced. On the twenty-first day competitive swimming was started and after the twenty-eighth day the full athletic program including contact sports was followed.

Each patient was checked several times postoperatively and on leaving this activity, and in no case was there any evidence of hernia following this active postoperative regime.

There was only one postoperative pulmonary complication in this group, that being a mild atelectasis occurring in one of the three patients kept in bed because of their extended incisions.

Though spinal headaches were frequently encountered, the incidence was no higher than in the hernia patients who were kept in bed. In no case did the headache persist after the discharge date. Only one subcutaneous serum collection was encountered, which also was the only case in which a cotton ligature was extruded.

Of the total number of cadets operated upon, 23 percent were subsequently dropped from the program for reasons not related to their temporary disability. With the exception of one who completed training with an additional 2 weeks' work, all the cadets operated upon were graduated with their regular battalions.

The physical fitness indexes of this group are compared in the table below with the cumulative average of the 19 battalions. While the improvement of this group is not as great as the cumulative average for the 19 battalions, it is considered adequate for graduation from the Pre-Flight Training Program.

	Initial	Final	Improvement
Cumulative average for 19 battalions.....	75.88	85.63	9.75
Average for group.....	76.23	81.00	5.77

CONCLUSIONS

1. An active postoperative ambulatory treatment was carried out in 46 cases of acute nonperforative appendicitis.

2. Early return to an active sports program was not associated with hernia or any other complications.

3. Only one cadet was delayed in graduating with satisfactory improvement in physical fitness from the 3-month training program.

LOW BACK PAIN: SUBLUXATIONS OF APOPHYSEAL JOINTS AND FRACTURES OF ARTICULAR FACETS

WENDELL G. SCOTT
Commander (MC) U. S. N. R.

A review of the records at a large Naval air center for the first fifteen months of this war reveals that roentgenographic examinations of the lower part of the back represented the third most frequent roentgenologic procedure; the chest and extremities being first and second. The roentgenologic study of men in the military service with the symptom of low back pain is important in any decision as to whether a man should be retained or surveyed out of the service. Every effort must be made, therefore, to demonstrate objective findings that are responsible for the pain or to be certain that no pathologic disorder exists. Fortunately in most cases the diagnosis is apparent from a study of the usual roentgenograms; however in a small but significant group of patients the diagnosis is more difficult, or may even remain obscure. These are the cases that challenge diagnostic ability. Among these there are some subluxations of the apophyseal joints and fractures of the articular facets.

Routine examination of the lumbar spine and proximal portion of the sacrum consists of four roentgenograms: The anteroposterior, the lateral, and the right and left oblique. The oblique roentgenograms are necessary to give adequate visualization of the apophyseal joints and the articular facets (1) (2). Three practical suggestions are offered about taking them:

1. Allow considerable leeway in the angle at which the side of the body is raised, because there is a wide variation in the obliquity of the facets among persons, and between the vertebrae in the same person. The angle may range from 30° to 45°. In practice the patient is kept in the initial position while the film is developed. A quick look at the wet film will determine whether further adjustment is required.
2. The opposite oblique film is then made at the selected angle.
3. Take enough oblique films at slightly different angles to delineate fully all the facets.
4. Place a translucent cotton roll about 3 inches in diameter just above the crest of the ilium to prevent the lumbar spine from sagging and to give a clearer definition of the joint spaces.

The roentgenologic diagnosis of subluxations of the apophyseal joints

has not received the attention that it warrants, partly because the anatomy and the normal movements of these joints are not widely known and also because of the lack of a clear understanding of the factors that produce a true subluxation.

ANATOMY AND NORMAL MOVEMENTS OF APOPHYSEAL JOINTS

Anatomy of apophyseal joints and articular facets.—Anatomically, these joints are formed by the inferior articular facet of the vertebra above and the superior articular facet of the vertebra below. The facets are made of strong hard compact bone, which explains why they stand out in contrast to the soft cancellous bone of the bodies of the vertebrae on the roentgenogram. The articular surfaces of the facets are covered by hyaline cartilage. These joints are surrounded by a joint capsule which is lined by a synovial membrane and contains joint fluid. They are true diarthrodial joints like the knee and elbow and as such are subject to the same diseases. The anterior surface of the facets forms the posterior border of the intervertebral foramen through which passes a lumbar nerve root. This is an important relationship, because according to Ghormley and Kirklin (3) some back injuries may produce sufficient edema and swelling of the joint to narrow the foramen enough to compress the nerve root.

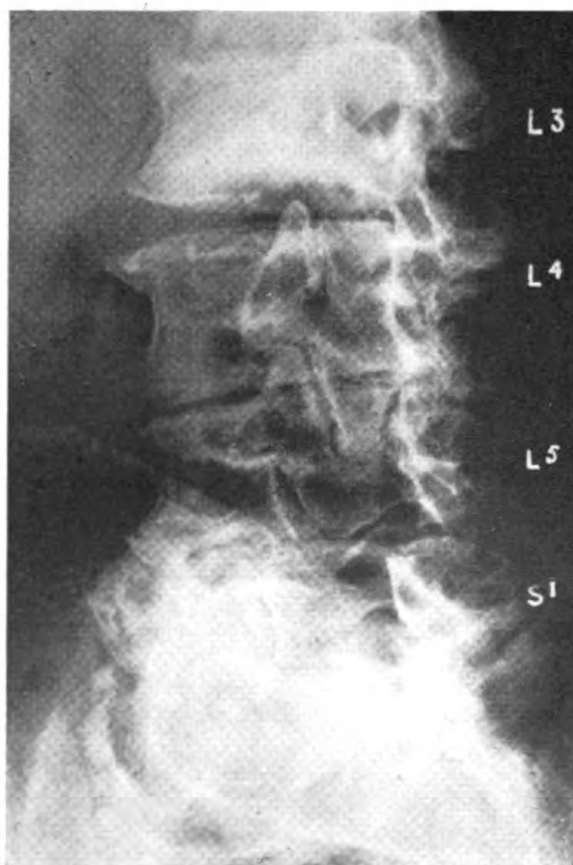
Usually the articular surfaces of opposing facets are of the same size and lie in complete apposition without any overlapping. This is not always the case, as not infrequently the opposing facets appear to have slipped past each other. When this is seen alone, it is of no clinical consequence, and as will be pointed out later, it can be readily distinguished from a true subluxation of importance.

Motion in the apophyseal joints.—The apophyseal joints are probably the most active joints in the body; they participate in every movement that involves the back or trunk. In children and young adults their range of motion is surprisingly great. In a 12-year-old contortionist the opposing facets of the lumbar apophyseal joints slip past each other far enough between full hyperflexion and hyperextension to increase or decrease the intervertebral foramen from 50 to 75 percent without producing compression of the traversing nerve root as evidenced by sciatic pain (4).

Roentgenograms of adults show a gradual decrease in the range of motion with an increase in age, but even in a 50-year-old man the opposing facets are seen to slip past each other as much as 30 percent of their length. Knowing the extent of normal motion that exists in the apophyseal joints, it is impossible to make a diagnosis of subluxation based only on the observation of an overriding of opposing facets followed by the inference that the joint capsule is stretched and therefore causes pain. Nor is it possible to estimate the degree

of narrowing of an intervertebral foramen resulting from an overriding of the facets which is necessary to produce compression of the traversing nerve root with consequent pain. Furthermore, even in the examples of extreme motion there remains considerable free space between the tip of the inferior facet and the lamina of the lower vertebra and between the tip of the superior facet and the pedicle of the upper vertebra. Consequently, to interpret such overriding of opposing facets without other changes as a subluxation is to resort to supposition and inference. We do not consider them as subluxations.

Roentgenologic diagnosis of apophyseal subluxations.—Roentgenologically, subluxation of the apophyseal joints is defined as an incomplete dislocation caused by a thinning of the intervertebral disc with impingement of the facets on the pedicle and laminae of adjacent vertebrae. Figure 1 is an excellent example and its accompanying case history is typical. The diagnosis is an objective one and is dependent on two associated factors (4):



1. Example of subluxation of apophyseal joint. Subluxation is in the joint between the fourth and fifth lumbar vertebrae and exhibits criteria for roentgenologic diagnosis: Thinning and degeneration of intervertebral disc; a vertical shift in alignment of articular faces of opposing facets, and impingement of tips of facets on adjacent vertebrae.

The patient, a 53-year-old man, had engaged in heavy manual labor for many years. For the last 4 years he experienced a constant localized pain low in the back, which was worse while working or lifting. During the last 8 months he could work only in a supervisory capacity.

1. There must be definite narrowing of the intervening intervertebral disc between the facets that form the apophyseal joint in question. The word *must* is used because in no other way can the facets slip past each other to an abnormal extent and remain in that position. It is possible in extreme hyperextension to separate the facets sufficiently to produce a subluxation, but this usually results in a fracture of the

facets. A subluxation of this kind has not been seen at this air center. Violent hyperflexion produces serious compression fractures of the bodies of the vertebrae, almost invariably without detectable apophyseal subluxation. Undoubtedly acute subluxations do occur with a stretching of the joint capsule by hyperflexion or rotation, but the moment the person assumes his usual posture, the facets return to their normal position. In roentgenograms made and examined in such cases the joints appear normal. Such acute subluxations do not represent a demonstrable roentgenologic entity.

2. The dislocation of the facets, as the result of the narrowed disc, must be sufficient to produce bony impingement of the tip of the superior articular facet on the pedicle of the upper vertebra and of the tip of the inferior facet on the lamina of the lower vertebra. This is necessary, because the facets, as already shown, can slip past each other considerable distances by changing the position of the body, without producing either local or referred pain along the nerve trunks. The bony impingement of these structures against each other results in sclerosis, eburnation, and erosion. The degree and predominance of these factors depend chiefly on the duration and amount of pressure exerted. The tips of the facets become worn and flattened. The facets, pedicles, and laminae were not designed to support weight, so that the reactions that develop in them are the chief explanation for the pain that these patients experience. This view was originally expressed by Hadley (5).

Nothing has been said about subluxation of the apophyseal joints in the anteroposterior plane or in the lateral plane. Taylor (6) was the first to point out that the direction in which the facets face would be the determining factor in this condition. Nearly always the faces of the facets are concave and are set in an oblique plane. Taylor noted that variations occurred in the plane of the articular surfaces in different persons. When the articular surfaces parallel the anteroposterior plane, for example, it is possible for the vertebrae, under the proper circumstances, to slip forward. When the articular surfaces are in the lateral plane, it is possible for the vertebrae to slip sideways but not forward. Undoubtedly such variations "give improper support to the body structures and are deficient in their weight-bearing and strain-resisting properties." There has been no opportunity, however, to recognize on the roentgenogram sufficient slipping in either the anteroposterior or lateral plane to warrant a diagnosis of apophyseal subluxation. Certainly it is possible and should always be looked for as a possibility.

Clinical features of apophyseal subluxations.—With the realization that the basic pathologic condition in producing apophyseal subluxations is a narrowing and degeneration of the intervertebral disc, it is apparent that apophyseal subluxations constitute a chronic disease of

adults and are most common among those in the fourth, fifth, and sixth decades of life. In the Navy they are seen usually in the older CPOs and in men who have been engaged in heavy manual labor. These men give a history of low back pain coming on gradually and extending over a period of many months to many years. In one particular their story differs from the usual "chronic back" case—the pain is constant for several months. It is usually described as a dull ache and is localized over the area of the subluxated joints. Corresponding tenderness can be elicited by direct pressure. The condition is sufficiently disabling to prevent men from doing heavy labor. Frequently they have to be transferred to other shops or duties where the work is lighter.

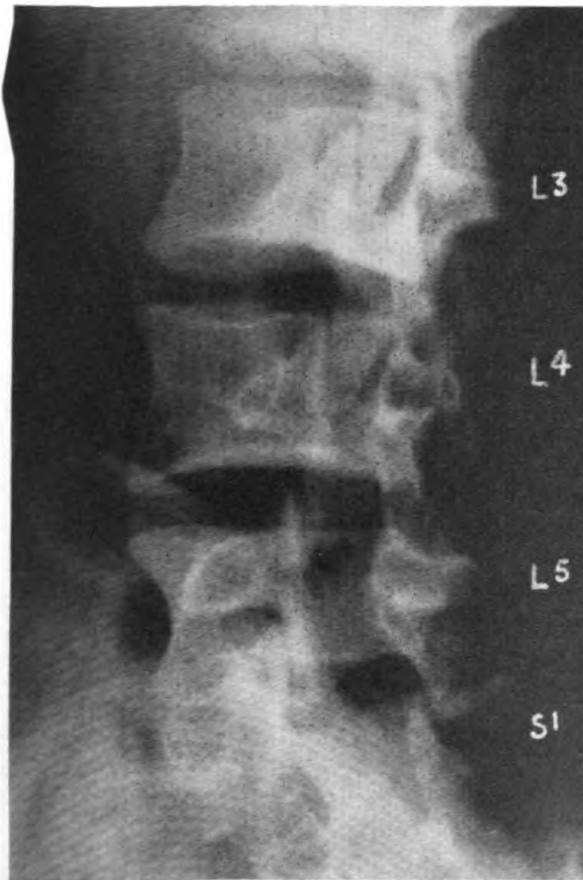
The constant pain may be accompanied by pain radiating down the leg along the course of the sciatic nerve. As a rule this means that in addition to the narrowed intervertebral disc and the apophyseal subluxation there is also an intraspinal protrusion of the disc causing direct pressure on the nerve root. In those patients with sciatic pain, spinal myelography should be employed to confirm the presence of this complication or of a hypertrophy of the ligamentum flavum. Invariably one or the other is the cause of the sciatic pain, and not the narrowing of the vertebral foramen occasioned by the overriding facets. It is of practical importance for the roentgenologist to recognize both the apophyseal subluxation and the intraspinal protrusion of the disc when they exist together if the patient is to receive the proper treatment and relief from pain. If only the protruded intervertebral disc is removed, the constant pain caused by the subluxation remains. If only a spinal fusion is performed for fixation of the back and stabilization of the weight-bearing surfaces, the sciatic pain remains.

FRACTURES OF THE ARTICULAR FACETS

Fractures of the articular facets involve structures similar to the apophyseal joints and produce clinical manifestations somewhat similar to apophyseal subluxations. Furthermore it is reasonable to assume that in this warfare of planes, tanks, tractors, and high explosives with attendant sudden and violent injuries, more fractures of the facets will occur and it is necessary to be alert to detect them. Fractures of the articular facets usually accompany any fracture of a vertebra with anterior dislocation of the body on the vertebra below. Such fractures are easily recognized. Isolated fractures of the articular facet or facets are not so apparent. Oblique roentgenograms of the vertebrae are often necessary for their recognition; certainly they are indicated in the examination of patients with a history of a back injury when the anteroposterior and lateral roentgenograms appear normal.

Isolated fractures of the articular facets are infrequent. They are usually the result of forces that produce extreme hyperextension or a twisting of the trunk or both. The force is generally applied suddenly and without warning. Most of the patients state that they experienced immediate pain and felt "something snap" in their backs. The pain and tenderness are localized to one side of the midline in the region of the underlying fracture. The patient may say, "The pain is right there," as he places his thumb on the spot. The pain is disabling and persists. It may be temporarily relieved by remaining immobile in bed but recurs with movement of the spine. Small fractures across the tip of the facet may heal spontaneously, but those across the base of a facet as a rule require surgical treatment.

In the roentgenologic detection of these fractures, they must be distinguished from the so-called accessory ossicles or persistent epiphyses that occasionally are seen at the tips of the facets. Bailey (7) lists these chief differential points. The persistent epiphyses are often multiple and usually bilateral. They are smooth, well-rounded and surrounded by a cortex. The fractures have irregular and serrated lines with comminuted fragments. Fractures can be present



2. Fracture of inferior articular facet of the third lumbar vertebra. The fracture is distinguishable from a persistent epiphysis by the history of sudden pain following a back injury; ragged and serrated line of separation; and absence of a cortical line around fragment.

A young man was struck in the back by an automobile and thrown to the ground. As nearly as could be ascertained the blow produced a hyperextension and rotation of the spine which is the usual force in causing these fractures. Pain was severe, constant, and localized in the area overlying this facet.

only in patients with a history of trauma. Figure 2 is a typical example of an isolated fracture. The case history accompanies it.

SUMMARY AND CONCLUSIONS

1. Subluxations of the apophyseal joints and fractures of the facets may occur with greater frequency as a result of the increase in trauma and strain incident to modern mobile warfare.

2. The roentgenographic examination of patients with low back pain should include posterior oblique films of the apophyseal joints and facets if they are to be visualized adequately.

3. The roentgenologic diagnosis of subluxations of the apophyseal joints is based on the following criteria which occur in this sequence: (a) A narrowed intervertebral disc; (b) excessive overriding of the articular surfaces of opposing facets; (c) impingement with erosion and sclerosis of the superior articular facet of the lower vertebra on the pedicle of the vertebra above and of the opposing facet on the lamina of the vertebra below.

4. Patients with apophyseal subluxations and sciatic pain should be examined by spinal myelography to determine the presence of an intraspinal protrusion of the disc. If present, surgical measures should include both lesions for total relief of pain.

5. Isolated fractures of the articular facets are infrequent, but should be carefully looked for in patients with persistent disabling back pain which dates from a back injury.

REFERENCES

1. HUBENY, M. J.: Oblique projection in examination of lumbar spine. *Radiology* 16: 720-724, May 1931.
2. MORTON, S. A.: Value of oblique view in radiographic examination of lumbar spine. *Radiology* 29: 568-573, November 1937.
3. GHORMLEY, R. K., and KIRKLIN, B. R.: Oblique view for demonstration of articular facets in lumbosacral backache and sciatic pain. *Am. J. Roentgenol.* 31: 173-176, February 1934.
4. SCOTT, W. G.: Low back pain resulting from arthritis and subluxations of apophyseal joints and fractures of articular facets of lumbar spine. *Am. J. Roentgenol.* 48: 491-500, October 1942.
5. HADLEY, L. A.: Subluxation of apophyseal articulations with bony impingement as cause of back pain. *Am. J. Roentgenol.* 33: 209-213, February 1935.
6. TAYLOR, R. G.: Anomalies of lumbosacral articulations. *J. A. M. A.* 113: 463-465, August 5, 1939.
7. BAILEY, W.: Persistent vertebral process epiphyses. *Am. J. Roentgenol.* 42: 85-90, July 1939.

TENDON REPAIR

THOMAS C. COLE

Lieutenant (MC) U. S. N. R.

A method of repairing severed Achilles tendons is presented that has been used in considerably more than 100 cases. The difference between this and the usual tendon suture is that all pull is removed from the cut ends by a fairly heavy tension suture inserted through both skin and tendon about 1 inch above and 1 inch below the cut surface. In principle and practice these sutures are inserted and have the same function as tension sutures used in an abdominal closure. The actual suture of the tendon end is much simplified, as all that is needed is an accurate end-to-end approximation of the tendon by one or two silk, cotton, or catgut sutures. These approximating sutures will not have a tendency to cut out if the tension sutures have been properly inserted.

Objections to this suture are no more valid than those made to bone traction or tension sutures in abdominal closures. Infection around the traction suture has been seen, but the only treatment required was removal of the suture. It is believed that the advantages far outweigh the disadvantages of the accepted method of suture. Some of these disadvantages are the wide exposure of tendons which causes some loss of tendon vitality, and wide raising of skin flaps which predisposes to skin necrosis in the presence of infection. Also the elaborate suturing necessary to prevent the sutures being pulled out interferes with nutrition to the tendon, and finally, end-to-end approximation is not always easy.

The technical end of the repair is simple. The patient is anesthetized and the wound cleansed. Where gross contamination is present, sterile water or saline is used freely, followed by ether and merthiolate; in the ordinary case ether and merthiolate only are used. The wound is draped, and the knee and ankle are flexed. The proximal tendon end, which has retracted from $\frac{1}{2}$ to 2 inches, is grasped with a large Ochsner forceps through the original incision (an Allis forceps will not hold the tendon) and is pulled down into the wound. A towel clamp transfixes the tendon about $\frac{1}{2}$ inch from the end. The direction of the clamp is parallel to the tendon, up the leg, out of the wound field, and serves two purposes: (1) Keeps the tendon in the operative field; (2) keeps the skin out of the operative field.

This clamp stays in place until all sutures except those in the skin are tied.

This is a minor though important detail, as otherwise the tendon may be lost several times during the operation and the approximating tendon sutures may be pulled out. The lower end of the cut tendon is easily exposed by plantar flexion of the foot.

The next step is a simple end-to-end approximation of the tendon ends by one or two catgut sutures, in this case No. 2 chromic. This suture is not meant to do anything except approximate the ends, all tension being removed by one or two transfixion sutures. Silk sutures are not used, though possibly they will work as well or better. Catgut used in this way causes little trouble and in the occasional infected case does not require removal. Possibly a smaller chromic suture could have been used. In small tendons when transfixion sutures remove pull from the ends, No. 000 or No. 00 chromic on atraumatic needles would be ideal if the operator preferred absorbable sutures.

A stainless steel wire suture (the size of tonsil wire) is inserted through the skin and tendon from $\frac{3}{4}$ to 1 inch above and below the cut ends so that there is no pull on the cut ends when tied. This suture is left in place 15 days unless there is infection, and even then is left several days in order to immobilize the ends as long as possible. The towel clamp is removed when this suture is tied.

The next step possibly could be omitted, but was used routinely in our cases. Medium sized silkworm suture is inserted about $\frac{1}{2}$ inch from the cut end of the tendon in the same manner as the previous suture, and in addition is inserted through the cut skin edges to approximate and evert them. This prevents dead space between the tendon and skin.

Finally two to three eversion sutures are placed through the skin margin, giving a skin closure like that obtained with skin clips. When the foot is in moderate or extreme plantar flexion there will be an excess amount of skin which smooths out when the foot is dorsiflexed.

Bleeding should be stopped without ligatures if possible. A sulfonamide should be lightly dusted in the wound, and a minimum amount of buried suture used.

A plaster cast is applied to the thigh, knee and foot with the knee flexed to 90° and the foot between moderate and extreme plantar flexion.

In the absence of infection the skin sutures are removed in 10 days, the wire tension suture is removed in 15 days, and the cast in 20 days. The patient may be allowed gradual use of the foot, or slightly more rapid recovery may be obtained by using a Böhler walking cast and iron.

The presence of infection is easily determined by pain and fever. When present, a window is made in the cast, the skin sutures are

removed, but the wound is not opened. The wire tension suture is left 2 or 3 days. The leg is elevated and continuous dry heat applied. A sulfonamide is given. Although disability is prolonged a satisfactory result with union of the tendon will usually be obtained. The cast is left on for the regular length of time. Where wide exposure of the tendon has been made, necrosis of the skin corners as well as a portion of the tendon has been seen when infection was present.

Several cases were treated by removal of the cast in 2 or 3 days. The tendon healed satisfactorily, but this does not seem to be the best treatment.

A modification of the described technic was used in the repair of a cut tendon of the finger and in the repair of a laceration of the tendons of the palm. The results were better than had been obtained previously. In the latter case the tension sutures were left in place 6 weeks and no infection or disability resulted. Small silk sutures were used to approximate the tendon ends.

Infection was seen in about 5 percent of the cases repaired and even then the majority healed satisfactorily. As many as 20 repairs have been done in an afternoon with no failures and no infections. This method of repair plus the sulfonamides locally and orally should make possible the immediate repair of tendons which formerly might not have been attempted.

The results were much better in our cases after the changed technic. For instance, infection was the exception rather than the rule. Previously it was not unusual for portions of the skin and tendon to slough out, resulting in a permanent scar with tender delicate skin at about shoe-top level, and in a fair percentage of cases secondary repairs had to be made after an interval of several months.

If the tendon cut is made so close to the calcaneus that there is no tendon for the distal end of the tension suture, the lower end of the suture may be inserted into the thick tissue behind the calcaneus. There is always sufficient tissue for approximation of the cut ends.

When the cut is made into the capsule of the ankle joint, only the tendons and nerves are sutured. In deeper cuts the peroneal tendon and possibly others are involved. The capsule of the joint heals without suture.

If more than one cut is made into the same tendon, the tension suture is made above and below the cut portion and approximation sutures are placed as described in each end of the isolated portion. The skin and the tendon sheath over the isolated portion of the tendon are not opened, first because it is not necessary in the repair, and second because if they are opened the chance of the isolated portion healing is diminished.

If the Achilles tendon is cut in the same place a second time it will be found that neither end will retract. It is neither necessary nor

desirable to free the tendon ends from the skin. Tension sutures are placed as described and eversion skin sutures placed so that the tendons will be end-to-end, but no sutures are placed in the tendon end itself. A cast is applied as described and left at least 30 days because healing is slower. If desired an attempt can be made later to free the tendon from the skin, although in all probability it will not work and the leg will function satisfactorily without freeing the tendon.

The opinion is held by some that these tendons will heal without being sutured. This was not found to be true in our experience; secondary repairs were done on two cases at intervals of 6 months to one year and no evidence whatsoever of union was found. These individuals could walk but could not run. Repair was as described except that the scar tissue had to be removed from the tendon ends and that the tendon was shortened for a considerable period. This shortening can be overcome by use or by applying a walking cast. The latter, however, is preferred since the period of recovery is shortened considerably.



SULFONAMIDES FOR INFANTS

Studies of the absorption, excretion, and distribution of sulfapyrazine (2-sulfanilamidopyrazine) in adults have been reported. Comparison of studies on adults and on children receiving other sulfonamide drugs indicates that in the two groups the same relationship does not exist between the quantities of drug given and the concentrations obtained in the body fluids.

Children with various types of mild or moderately severe infections were given sulfapyrazine orally with as close adherence as possible to the following dosage scheme: 0.1 gm. per kg. body weight was given as initial dose, followed by 0.2 gm. per kg. per 24 hours in 4 divided doses. Blood levels of the free drug were determined at intervals during the course of several days of drug administration.

Results.—The average of all the determinations for the entire group was 4.3 mg. per 100 cc.; for those over 2 years of age 5.3 mg. per 100 cc.; and for those under 2 years of age 3.3 mg. per 100 cc. Lower blood levels in infants on proportionate dosages have been noted with the other sulfonamide drugs.

Comparatively uniform blood levels are maintained when the drug is given by mouth at 6-hour intervals.

High blood levels of the drug can be rapidly attained and maintained by the subcutaneous administration of sodium sulfapyrazine.

With comparable blood levels, the therapeutic effectiveness of sulfapyrazine appears to be equal to that of any of the commonly used sulfonamide drugs.—BARNETT, H. L.; PERLEY, A. M.; FORBES, G. B.; and GOLDBRING, D.: Use of sulfapyrazine in infants and children. *Am. J. M. Sc.* 206: 599–610, November 1943.

RECEPTION AND TREATMENT OF CASUALTIES ABOARD AN ASSAULT TRANSPORT

BARNES GILLESPIE
Lieutenant (MC) U. S. N. R.

and

J. CUTHBERT OWENS
Lieutenant, Junior grade (MC) U. S. N. R.

This assault transport recently completed an operation in the Pacific with the evacuation of Marine and Naval casualties. This report covers a description of the injuries received and their relation to this type of amphibious operation, as well as their care, and resultant statistics based upon the study of these patients aboard this transport for a period of from 9 to 13 days.

Since the operation was of an amphibious nature entirely, there are several distinctive features about the injuries which are worthy of note. Many of the troops were injured while attempting to wade into the beach from a distance of 300 yards under heavy enemy gun-fire consisting of machine gun, rifle and mortar. Numerous upper extremity, head and neck wounds resulted.

Surprisingly not one blast injury was received aboard. This may have been due to the fact that no bombs of any consequence were dropped from enemy planes. Most of the large gun emplacements had been eliminated before the initial assault waves landed. A high incidence of shell fragment injuries occurred when mortar shells dropped on a boatload of men, causing also a high total of submersion cases. Our 7.3 percent of submersion cases is small in comparison to the number of men actually drowned as an indirect result of such an occurrence. Three of the four burn cases were in one amphibious tank which was struck by an incendiary shell.

The evacuation of patients took place exceptionally soon after their injuries, some within the first hour and the majority in from 4 to 8 hours. The speed of their return was largely due to their remaining within the landing boats. These constituted a relatively large percentage of the early arrivals; those on the beach were delayed somewhat until organization had been established. Seven of the patients however came aboard after having received no treatment until 3 days following their injuries. This was due to their inaccessibility and the position of the battle. Upon coming aboard they received a prophylactic dose of combined tetanus and gas gangrene antitoxin.

Little had been done for the patients while on the beach owing to the aforementioned hostilities and the difficulty of obtaining proper supplies. First aid, morphine, and plasma were administered when necessary, following which all patients were evacuated promptly if possible. The speed of evacuation largely accounts for the fact that there were only 11 deaths, 5.4 percent of all our cases. Seven of these occurred either previous to their arrival aboard or very shortly thereafter.

Casualties were received aboard from landing craft 3 hours after the initial landing on D day. The majority of these were taken aboard at one debarkation station, and in most instances the boat was hoisted to the rail and the patients transferred to the ship in litters. Such procedure eased the work of the deck division, speeded reception of the casualties, and tied up the landing craft for a minimal length of time. The Stokes stretcher hoist was used for single cases. Although equipped, we did not use the sling lift for litters or the salmon board.

At the rail the patients were entered in a casualty book, retagged, and routed to the proper ward, dressing room, or operating room. Five sets of wooden sawhorses, 30 inches tall, had previously been installed in the sickbay area to accommodate litters. These proved of great value when several seriously wounded men were received at one time.

It is necessary to divide the injuries into groups somewhat categorically in order to show the relation between the military operation and the type of wounds. As in all battle casualties there is an unusually high number of multiple injuries, many of which we are unable to record in this report. Cases with two or more injuries are regarded as multiple wounds unless they involve major structures. In a few instances two major injuries were received by the same patient and then the most important structure involved has been recorded to prevent overlapping. Flesh wounds which coexisted with compound fractures have not been listed even though some presented a large defect. Some of the gunshot wounds also had fragment wounds present in some other area or vice versa; here again only the most important wound is listed. There was a group of a few unusual admissions such as malaria, heat exhaustion, sprain and contusion. The various types of injuries are classified in table 1.

TABLE 1.—*Classification of injuries*

Injury	Number of cases	Percent-age	Deaths
Wounds, gunshot:			
Extremities:			
Arms.....	14	6.85	
Legs.....	15	7.35	
Shoulders.....	7	3.4	
Head:			
Skull.....	3	1.47	3
Scalp.....	2	.98	
External ear.....	1	.49	
Neck.....	4	1.96	
Trunk:			
Chest wall.....	3	1.47	
Lung.....	10	4.9	1
Pleuro-abdominal.....	1	.49	3
Back.....	5	2.45	
Abdominal wall.....	2	.98	
Liver.....	2	.98	1
Kidney.....	1	.49	
Bladder.....	2	.98	
Intestine.....	1	.49	1
Buttocks.....	1	.49	
Multiple.....	6	2.9	1
Total.....	80	39.2	10
Wounds, shell fragment:			
Extremities:			
Arms.....	14	6.85	
Legs.....	16	7.84	
Head:			
Skull.....	0	.00	
Scalp.....	2	.98	
Face.....	4	1.96	
Neck.....	3	1.4	
Shoulders.....	4	1.96	
Trunk:			
Buttocks.....	3	1.4	
Chest wall.....	1	.49	
Lung.....	1	.49	
Abdominal wall.....	2	.98	
Back.....	2	.98	
Multiple.....	16	7.84	1
Total.....	68	33.3	1
Fractures, compound:			
Multiple:			
Humerus and femur.....	1	.49	
Femur and patella.....	1	.49	
Radius and ulna.....	2	.98	
Fibula and os calcis.....	1	.49	
Humerus and radius.....	1	.49	
Tibia and fibula.....	2	.98	
Single.....	11	5.39	
Total.....	19	9.3	
Fractures, simple:			
Ribs.....	1	.49	
Metacarpal.....	1	.49	
Total.....	2	.98	
Burns:			
Second degree:			
Body and legs.....	1	.49	
Hands.....	2	.98	
Arms and legs.....	1	.49	
Total.....	4	1.96	
Miscellaneous:			
Contusions:			
Leg.....	1	.49	
Shoulder.....	1	.49	
Sprains:			
Knee.....	1	.49	
Arm.....	1	.49	
Malaria.....	1	.49	
Submersion.....	15	7.35	
Heat exhaustion.....	3	1.47	
Psychoneurosis, situational.....	5	2.45	
Dislocation, shoulder.....	1	.49	
Total.....	29	14.2	

Flesh wounds.—The wounds varied greatly in size, from minor penetrating wounds to areas of from 12 to 14 inches. One death resulted from a fragment wound of the buttocks and thighs, covering such a wide area that every emergency attempt failed to relieve the shock present. Some superficial wounds were made by fragments flying tangentially and tearing away the skin; others caused large avulsed areas including destruction of muscles and underlying bone, frequently with the bone protruding and the anatomic structures well exposed.

The absence of any marked infection, gas gangrene or tetanus was remarkable. The latter may be attributed to: (1) A large number were clean gunshot wounds, (2) the soil on the island was not highly cultivated, (3) a fair number of patients never reached the shore but were returned directly from the boats or the wooden landing pier, (4) all personnel had been actively immunized against tetanus with routine toxoid injections, (5) those with delayed treatment received combined serum, (6) very little debridement was carried out and drains were inserted whenever possible, and (7) sulfonamides were used freely both orally and locally. Our only infections per se were in three of the patients whose treatment had been delayed on the beach for 3 days.

A few patients transferred from another ship had received primary suture of their wounds. These showed a tendency to become infected, resulting in our decision to remove the sutures for adequate drainage. One patient with an amputation of the leg ran a septic course for 24 hours after arrival. When a few sutures were removed and drains inserted he began to recover without any further complications.

Sulfathiazole was administered routinely to all wounded patients for the first 3 days, without any toxic complications developing other than nausea and vomiting. Subsequently it was discontinued because the absence of spreading infections made its use unnecessary.

A majority of the wounds were through and through, carrying away bones, large vessels and nerves. In almost every instance the point of entrance and exit could be determined, whether the wound resulted from fragments or gunshot.

Excepting the operative cases, all of the patients received conservative treatment consisting of blood transfusion, plasma and morphine when needed. The wounds were allowed to remain open with rubber drains inserted when necessary, and the area was frosted with sulfanilamide powder and overlaid with vaseline gauze. A great majority received immobilization, some even when doubt existed as to its necessity.

Head injuries.—No neurosurgical procedures were necessary in any of the head cases as they were all scalp wounds which were treated as

any other type of wound. Injuries of the face were of such minor nature that the preferred treatment of primary suture was not necessary. Three skull fracture casualties were received dead.

Chest injuries.—Four of the deaths resulted from chest wounds, three occurred almost immediately after admission and the fourth from a cerebral embolus 4 days after injury. Seven other patients showed evidence of lung injury, with initial hemoptysis and chest signs of hemothorax or pneumothorax. Only one case presented any respiratory embarrassment. The patient was given oxygen immediately and placed on the involved side, after which improvement was so marked that thoracentesis did not seem justified. None of the patients had a temperature of over 101° F.

Two patients showed a sucking type of chest wound upon arrival. Immediate primary suture was performed in both cases and no subcutaneous emphysema followed. One had a pleuro-abdominal type of injury with the lung edge "lapping" out of the wound. Closure of the wound failed to save the patient's life. No complications developed in the 7 remaining chest injuries, though convalescence was slow.

Abdominal injuries.—Though there were 37 trunk injuries, only 7 showed intra-abdominal involvement. One gunshot wound of the kidney was treated conservatively. The remaining 6 cases are discussed under operations.

Fractures.—Our greatest concern was with compound fractures, a total of 19 cases (9.3 percent). These were all splinted to the best of our ability with skin traction or plaster cast. No x-rays could be taken owing to the frequent movements of the ship in and about the area. For this reason these patients as a group received the poorest treatment. The most uncomfortable ones were those with injuries involving joint spaces, and those in whom two extremities had been fractured. One patient with a fractured humerus had such a large hematoma that dry gangrene developed in his hand, making amputation necessary. If this patient had had early incision and drainage of the area with immobilization of the fractured bone, the result might have been more satisfactory.

Peripheral nerve injuries.—A prominent factor was the presence of peripheral nerve injuries, the greater number being associated with the compound fractures. The commonest site of injury was in the arm and shoulder. Seven and eight-tenths percent showed some type of peripheral nerve injury involving the following structures: Brachial plexus, 4; radial nerve, 3; ulnar nerve, 2; sciatic nerve, 2; radial and median nerves, 1; median nerve, 1; peroneal nerve, 1; and tibial nerve, 1.

No attempts were made to suture the nerves, because the wounds were not healed sufficiently to allow anastomosis of the ends of sev-

ered nerves with an aseptic field. Attempts were directed to promote healing of the wounds and to prevent overstretching of paralyzed muscles due to faulty posture during convalescence. A few cases began to show signs of recovery after a week, proving that what was originally thought to be an anatomic interruption was only traumatic neuritis. In some instances when traumatic neuritis was present the patients had to be given repeated doses of codeine and acetylsalicylic acid. One of the most painful was a penetrating wound of the lateral portion of the right lower quadrant of the abdomen involving the ilio-inguinal nerve.

Burns.—Four patients were admitted for burns, not one of which involved more than 20 percent of the total skin surface. These burns were first and second degree only. A compression bandage was applied to the extremities and sulfadiazine spray to the body; saline baths with continuous saline soaks were used for the cases involving the hands. Supportive measures were instituted immediately to prevent the onset of shock. Healing occurred with minimal scar formation. All three methods had their place, surgical cleanliness being the primary objective in each treatment.

Surgical operations.—Sixteen of the patients received definitive surgical measures beyond the routine treatment of gunshot wounds, fractures, and burns discussed above. Six were major abdominal operations, 3 involving minor debridement and primary repair of structures involved; 2 were for the removal of fragments; 1 for the repair of a cruciate ligament; 1 a phrenic nerve block; and 3 cases of fractured mandibles which were set by the dental officer. These latter cases are included in the statistics under more severe injuries.

There were 2 deaths in this group. The first patient was received aboard virtually eviscerated from two wounds in the abdomen. The initial shock was treated and then an exploratory operation done using spinal anesthesia. A portion of the transverse colon containing two perforations was resected and an end-to-end anastomosis carried out. A laceration in the descending colon 10 cm. in length was sutured. Approximately 8 cm. of the omentum was protruding from a separate wound to the right of the umbilicus. This was resected and both wounds were closed with drainage. In spite of supportive therapy the patient died a few hours after operation, having never completely recovered from his initial shock.

The second patient had received a gunshot wound in the right upper quadrant of the abdomen. Exploration was done under spinal anesthesia and the peritoneal cavity was found to be filled with old blood from a through-and-through ragged perforation at the anterior edge of the liver. The liver wound was packed with warm wet gauze and the abdomen closed with drainage. About 6 hours after operation

the patient developed a severe chill and fever; this may have been a recurrence of malaria which he had had in the past. He died soon afterward.

In one case of a gunshot wound of the upper abdomen the bullet had entered and apparently lodged in the liver. Using spinal anesthesia an irregular wound in the right dome of the liver was packed and the peritoneal cavity closed with drainage. The packing was removed on the sixth day, and the patient was in good condition when transferred from the ship. He received several units of plasma besides two whole blood transfusions.

Two patients had perforating bullet wounds of the urinary bladder. In each case exploration of the lower abdominal cavity was done under spinal anesthesia to rule out intestinal injury. Both wounds had an anterior entrance, one from left to right, the other from right to left. The first patient was received early, the bladder wounds were closed with catgut, and the abdominal wall was closed without drainage. A retention catheter was inserted for frequent irrigation. The flank wound drained urine for several days, but then closed and the patient made an uneventful recovery.

The second patient was received 2 days after injury. The same operation was performed except that a suprapubic catheter was left in the bladder. Attempts at catheterization were unsuccessful. It was later learned from a second operation performed ashore that the bullet had severed the prostatic urethra. The patient was in good physical condition on leaving the ship although he had not voided from the urethra.

Another gunshot wound of the upper abdomen proved at operation to be extraperitoneal. The wound was closed with drainage and the patient made an uneventful recovery. The two avulsed wounds, one of the posterior portion of the hand and one of the knee, were treated with a simple debridement and an attempt at tendon reconstruction in the hand. On leaving the ship both patients had developed a secondary infection although the wounds were granulating nicely.

One patient had a laceration of the medial cruciate ligament of the leg. Under pentothal anesthesia, repair was made with catgut and a posterior splint applied. One patient received from another ship had a gunshot wound of the left side of his back at the level of the diaphragm. He had almost continuous hiccups for 7 days in spite of the use of a long list of common remedies. The left phrenic nerve was dissected free in the neck and anesthetized. This had no immediate effect on the hiccups; however, they gradually subsided by the eighth day.

Psychoneuroses.—Five patients, a percentage of 2.4, developed neuroses. Only one of these patients failed to show any improvement

whatsoever. It may be pointed out that the engagement was short and neuropsychiatric problems did not arise since there was no prolonged strain on the troops.

Submersion.—Fifteen cases of submersion were received, none of which developed complications. No treatment was necessary other than rest in bed for approximately 48 hours.

SUMMARY

The reception and treatment of casualties aboard an assault transport in a recent invasion have been discussed.

Reception of casualties will be efficiently carried out if teamwork is impressed upon the men during frequent drills, beginning at the beach and including every involved individual until the patient is resting quietly in the sick space provided.

Table 1 may be of value in estimating the type of wounds to be expected in an amphibious operation.

Two principles in the local treatment of gunshot and shell fragment wounds were noted to give gratifying results outside of routine therapy: Widespread use of rubber dam drains and minimal debridement.



PENICILLIN THERAPY IN WEIL'S DISEASE

Leptospirosis icterohaemorrhagica (Weil's disease) has been reported in nearly every civilized country. Many cases have been reported in Europe, Japan and the East Indies. The mortality rate has varied from 5 percent in Europe to as high as 55 percent in Japan. It is probable that many unrecognized cases of Weil's disease have occurred in the United States. While serum has been of some value in the treatment of Weil's disease, it has not been uniformly satisfactory. In view of the previous reported effectiveness of penicillin against some spirochetal infections, we have examined its effectiveness in the treatment of experimentally produced infections due to *Leptospira icterohaemorrhagiae* in guinea pigs. In the final experiment reported in this paper, sixty-four guinea pigs were infected with *Leptospira icterohaemorrhagiae*. Of the thirty-two guinea pigs treated with penicillin, none died of the disease; three died from the toxic effects of penicillin. Of the thirty-two untreated guinea pigs, twenty-nine died of Weil's disease, a mortality rate of 91 percent.

The therapeutic effectiveness of penicillin on infections produced by *Leptospira icterohaemorrhagiae* in guinea pigs described in these experiments, makes it seem reasonable to suspect that penicillin will be useful in the treatment of Weil's disease and other leptospiral infections in man.—HEILMAN, F. R., and HERRELL, W. E.: Penicillin in treatment of experimental leptospirosis icterohaemorrhagica (Weil's disease). *Proc. Staff Meet., Mayo Clin.* 19: 89-99, February 23, 1944.

WORKING RULES IN THE FIELD ¹

SUPPLEMENTARY SUGGESTIONS ON CARE OF WOUNDED ²

EMILE HOLMAN
Commander (MC) U. S. N. R.

HANDLING IN TRANSPORTATION.

1. *Gentleness*.—Gentleness in handling and in transporting patients is an important preventive of shock.

2. *Morphine*.—Before a particularly difficult journey, either long or rough, an adequate dose of morphine should be given the seriously wounded and provision made for its repetition en route.

3. *Three-quarters prone position*.—A semiconscious or unconscious patient, or one with a wound of the face or jaw, or one who is breathing stertorously, should be placed and transported in the three-quarters prone position to prevent swallowing of the tongue and aspiration of saliva and blood.

4. *Fluids*.—(a) Water by mouth: While awaiting transportation and during transportation, patients must be provided with water by mouth. When fluids are tolerated, it is preferable to give them orally rather than parenterally. Dehydration may deepen or precipitate shock in a patient who has lost a great deal of blood. If water is not available, let the patient suck fluid from a salt solution flask through the rubber tubing provided.

(b) Intravenous therapy: The administration of plasma, blood, or salt solution by vein should not be overdone in a patient who is cyanotic, dyspneic, who has peripheral edema, or whose veins of the neck are distended from increased venous pressure, or in whom moist râles are audible on auscultation of the lungs. In the presence of a hemothorax or pneumothorax with complete collapse of one lung, intravenous therapy must be given guardedly.

(c) Oxygen: The administration of oxygen (obtained in the field from aviation units or construction battalions) by nasal catheter is more effective than intravenous therapy in patients with hemothorax or pneumothorax with collapse of a lung. The catheter should be

¹The following surgeons temporarily assigned as consultants to the Third Medical Battalion, Third Marine Division, Fleet Marine Force, participated in the discussions leading to these suggestions: Captain T. E. Reynolds, Commanders G. A. Esslinger, J. B. Josephson, E. F. Holman, W. L. Rogers, and A. J. Wineland—all of the United States Naval Reserve.

²See the UNITED STATES NAVAL MEDICAL BULLETIN, February 1944, for the first article on WORKING RULES IN THE FIELD.

placed so as to extend beyond the nasopharynx into the oral pharynx.

Intravenous administration of fluids is contraindicated in patients who show evidence of blast compression injuries of the chest. Administer oxygen intranasally instead, and do not permit such patients to be ambulatory.

THE TOURNIQUET.

1. *Use infrequently necessary.*—It is now generally recognized that the tourniquet should not be used unless it is imperative.

2. *Labeling.*—When the tourniquet is used, it is important to give notice of its presence, when applied and when last released, by conspicuous labeling on adhesive plaster. In hot climates adhesive plaster is easily sweated off when applied to skin; hence, a sufficiently long piece of adhesive should be applied around an arm, so that it may be stuck to itself. Do not cover a tourniquet with dressings, bandage, clothes or blankets, without safety-pinning a notice of its presence on the outside in a conspicuous area. Tell the patient to inform every medical officer or hospital corpsman who dresses or examines him that he has on a tourniquet.

3. *Release.*—The sudden release of a tourniquet may lead to profound shock; therefore apply pressure to the artery above the tourniquet before its release and determine whether or not such release is safe. Be ready to apply pressure immediately should serious bleeding occur upon release of the tourniquet.

4. *Refrigeration.*—The limb to which a tourniquet is applied should be cooled or refrigerated with ice when possible.

5. *Amputation.*—If a limb must be amputated, the tourniquet may usually be left in place until the amputation has been done.

ROENTGENOLOGIC EXAMINATION.

Whenever possible, and when the patient's condition permits, the patient, when first received at the hospital where definitive treatment is to be given, should be taken to the x-ray department, en route to the operating or dressing room, in his original dressings or splints, and roentgenograms should be made to determine the presence or absence of foreign bodies, their location, and whether a fracture is present or not.

The patient's story as to his position when struck and the probable position of the exploding shell, or of the sniper responsible for the injury, will suggest the structures in the probable path of the missile. Roentgenograms of these regions are invaluable in determining the early course of treatment.

ASSOCIATED NERVE INJURY IN GUNSHOT WOUNDS.

1. Examine every patient with a gunshot wound of an extremity for an associated nerve injury.

2. If evidence of nerve block is present, try to determine at operation if actual division has occurred or if only physiologic interruption by dispersion of energy is the cause of the anesthesia.

3. Record data on a chart and health record.

4. The divided ends of a severed nerve should be brought as near together as possible by interrupted sutures of a nonabsorbable material, either silk or steel wire.

5. Place the extremity in a plaster cast with the nerve in position of relaxation by flexion or extension of the adjacent joints.

SLIDE SMEARS.

In the operative care of a wound, precede debridement by making slide smears of widely separated areas of the wound for staining and microscopic search for types of organisms present, particularly with reference to the gram-positive gas-forming bacilli.

EXCISING AND INCISIONS IN WOUND TREATMENT.

1. In treating the wound proper, excise the traumatized rim of skin and enlarge the external wound by longitudinal incisions to the size of the underlying cavity. This incision should be in the direction of the underlying muscles and long enough to provide good exposure to the depths of all pockets of the wound.

2. Wounds in the skin and fascia are often small, whereas pockets in the underlying muscles are large owing to retraction of the divided muscles. Any pockets should be laid wide open by incisions in the skin, fascia, and muscle if necessary. A wound heals from side to side, not from end to end. The length of a wound made in the direction of muscle fibers is therefore relatively unimportant. Transverse incisions on an extremity either in skin or muscle are ill advised.

3. Excise badly lacerated frayed fascia and muscle that has lost its viability or contractility or that shows signs of gangrene.

4. Tissue into which dirt has been ground must be excised.

5. Explore the wound gently in all directions with gloved finger, following the track of the missile, which if felt should be removed. If the finger cannot reach the end of the wound, explore with a curved hemostat. The contact of metal against metal is unmistakable, and the early removal of metal fragments saves healing time. Following the track of a missile is easily done soon after injury but becomes difficult as exudation and fibrosis seal the wound.

DRAINAGE.

1. Puddling of pus should not be permitted in a wound, particularly one associated with a fracture.

2. A long blind wound track should be drained through a second incision.

3. Dependent drainage may also be provided by making a counter-incision in a nonvital area which will insure constant drainage when the patient is lying on his back.

The Russian surgeon Yudin provides a posterolateral incision in every compound fracture of the thigh at the level of and down to the fracture, in addition to debridement of the wounds of exit and entrance when located on other surfaces.

GAUZE BANDAGE CONTRAINDICATED IN HEMORRHAGE CONTROL.

Do not apply a circular gauze bandage to control hemorrhage by pressure and then cover this bandage with a plaster cast. Gangrene of the hand has been produced by infraction of this rule. A gauze bandage that becomes wet with blood and then dries under the cast may constrict the limb and produce peripheral gangrene as surely as a tight plaster dressing.

Dressings over a wound may be kept in place by several loosely applied turns of sheet wadding, or of stockinet cut on a bias, before the application of the plaster.

SPLIT CASTS IN FORWARD STATIONS.

It cannot be too strongly urged that skintight casts not be employed in the forward area where patients pass from the observation of the surgeon responsible for their application. All casts of the extremities must be split down the middle before patients leave the forward station where the casts are applied.

As an aid in cutting casts, include a long well vaseline-coated rubber tube laid anteriorly and exteriorly to the sheet wadding. This tube may be withdrawn immediately after the plaster has been applied. A tunnel is thus provided for the splitting of the cast with plaster shears or knife.

A piece of wool-felt, half an inch thick and 1 inch wide, applied the length of the cast anteriorly, will serve the same purpose. This cannot be withdrawn, however, but the shears or knife will follow the edge of the felt.

CONED GUILLOTINE TYPE AMPUTATIONS.

Amputations performed for infection, gas gangrene, or sepsis should be "coned guillotine" in type, below rather than at the site of election:

1. Divide the skin and subcutaneous fascia down to muscle, completely around the circumference, permitting the skin through its elasticity to retract as much as possible.

2. Divide the outer layer of muscles at this new level of the skin, permit their retraction, and divide the deeper layer of muscles at the new level down to bone.

3. Free the deep muscles from the bone for about 2 cm., permitting them to retract to the extent of their contractility.

4. Divide the bone at the level of this retracted muscle.

This procedure provides a flat, unpocketed, open surface for drainage and at the same time permits subsequent relengthening of the relaxed elastic muscle and skin to cover the bone end by traction on the skin.

Skin flaps.—When amputation is performed within 24 hours for a nonviable mutilated extremity with only minimal infection, skin flaps may be made but should never be closed primarily.

Secondary amputation.—Amputation at or just above the site of fracture with conservation of all good viable skin is always preferable, with acceptance of a secondary amputation at the site of election later. This procedure is most likely to give the best and longest workable stump in the greatest number of cases.

Traction: adhesive method.—Traction on the skin may be provided for immediately, but because of copious serosanguineous discharge, its application may be delayed until the first dressing 2 or 3 days later.

Arm: Traction on an amputated arm may be established by four strips of adhesive extending well beyond the end of the stump, to which weights or a small bag of sand or coral may be attached for continuous traction even when the patient is ambulatory.

Leg: Similarly, four strips of adhesive applied to the thigh or lower part of the leg before the application of the plaster cast will provide means for traction after the first dressing.

Traction: stockinet method.—Another satisfactory method of providing traction on a stump is to apply a double coating of compound tincture of benzoin to the skin area from 8 to 10 inches above the stump end, and roll over this area a snugly fitting stockinet, long enough to extend 12 to 15 inches beyond the stump end. To facilitate application of the stockinet a discarded x-ray film rendered sterile by immersion in alcohol may be coned over the tender raw stump, over which the stockinet may be slipped with ease, followed by withdrawal of the film. To this stockinet, traction may be applied by three methods: By suspended weights when ambulatory, by a turnbuckle attached to a Thomas splint or cast during transportation, or by pulley attachments over the end of the bed when the patient is hospitalized.

The stockinet also provides the effect of coning the soft tissues over the end of the bony stump.

Immobilization.—For comfort and for transportation, amputations through the thigh should be immobilized in a plaster hip spica. Amputations through the lower part of the leg should be encased in long thigh-leg plaster extending 4 or 5 inches beyond the stump of the slightly flexed knee. Amputation stumps of the upper extremity should be securely fixed to the chest wall by plaster dressing or by wide bandages.

FRACTURES OF THE HUMERUS: IMMOBILIZATION.

Fractures of the humerus are immobilized for transportation by fixation of the entire arm to the chest wall:

1. This is done by means of a shoulder spica of broad gauze bandages or of plaster.

2. Soft pads of cotton are first placed in the axilla and over the anterior thorax between the forearm and chest.

3. A long U-splint of plaster, 3 inches wide, will provide excellent splinting and comfort if it extends from the base of the neck over the point of the shoulder down the outer side of the upper arm, under the olecranon, and terminates on the inner side of the upper arm just short of the axilla. It is fixed in place by the shoulder spica.

4. Except when it is necessary to support hand and fingers for paralysis as a result of nerve injuries, do not extend the plaster dressing of the forearm beyond the palmar crease of the hand, in order to insure free mobility of the digits. Prevent a "frozen" hand by allowing active and passive motion of the fingers in all dressings, even those for burns.

LAPAROTOMY FOR ABDOMINAL WOUNDS.

1. In a laparotomy for abdominal wounds, a careful search to locate all perforations must be made.

2. In multiple perforations, it is best when possible to close the individual perforations rather than to perform resection of a long segment. The mortality from resection greatly exceeds that of simple closure.

3. It cannot be too strongly emphasized that wounds of the mesenteric border with extravasation of blood into the retroperitoneal tissues are highly dangerous, and must be exteriorized by colostomy or enterostomy at the level of the wound. Even lesions and wounds of the jejunum may be successfully exteriorized if the two arms of the enterostomy are sutured together for 2½ or 3 inches by parallel lines of approximation about three-fourths of an inch apart, continuous cat-gut suture being used on an atraumatic needle. This will permit gradual crushing of the spur for reestablishment of intestinal continuity at any time beginning after the third day.

4. In a late laparotomy performed 12 or more hours after injury when an injured segment requiring resection is already surrounded by an inflammatory exudate, it is preferable to perform an exteriorization or obstructive resection of the segment rather than excision and immediate anastomosis. An anastomosis performed in the presence of an established localized peritonitis will almost inevitably terminate in a generalized peritonitis and death.

5. Great care should be employed in appraising the extent, if present, of localized peritonitis around a perforation of the large bowel.

6. A recent wound of the antimesenteric border without evidence of localized peritonitis may be closed, but even a simple perforation of the large bowel, independent of the mesentery, must be exteriorized if there is any evidence of a well-developed localized peritonitis.

ROENTGENOLOGIC EXAMINATION IN INTESTINAL PERFORATION.

If preoperative confirmation by roentgenologic examination of an intestinal perforation seems desirable, do not attempt to place the patient upright for demonstration of air under the diaphragm. This may accentuate shock. It is better to roll the patient on his left side, elevate the head of the bed or gurney a few inches, and take a postero-anterior roentgenogram with the x-ray tube in a horizontal position. Free air, if present, will be demonstrated lying between the lateral abdominal wall and the liver in the right flank or lower thoracic region.

KIDNEY PEDICLE OR PELVIS WOUNDS.

1. Wounds of the kidney pedicle or pelvis are not necessarily accompanied by blood in the urine.

2. When location of the wound or of the bullet track suggests involvement of the kidney pelvis or pedicle, give diodrast by vein and determine urinary extravasation by roentgenogram. This can be done in half an hour.

3. A ruptured kidney pelvis must be drained, and the renal vessels must be ligated if injured, even when prolonged intra-abdominal repairs are necessary.

4. If drainage and hemostasis of the kidney are provided, the necessary nephrectomy may be deferred to a more opportune time.

TENSION PNEUMOTHORAX.

1. A tension pneumothorax is best released by a needle introduced into the second or third interspace in the nipple line anteriorly.

2. If air continues to escape, connect a long rubber tube to the needle and place its distal end under water.

3. If transportation of the patient is necessary, disconnect the underwater seal and tie over the exposed end of the needle, which will have been securely attached to the chest with adhesive, a rubber glove finger, or condom, the distal end of which will have been slit to provide a one-way valve for the escape of air.

HEART WOUNDS.

Wounds of the heart, although usually fatal, are sometimes compatible with survival if bleeding or if cardiac tamponade due to bleeding into the pericardial sac can be prevented or corrected. On occasion, the wound in the heart is associated with a rent in the pericardium sufficiently patent to permit the escape of blood into the thorax or mediastinum, thus avoiding tamponade but producing the effects of continual bleeding.

1. The location of the wound and of the presumed path of the projectile should be helpful in directing attention to the heart as the probable source of bleeding.

2. A wound near the heart or two wounds in whose connecting path the heart lies should suggest tamponade if the patient has marked dyspnea, pale ashen or cyanotic color of the skin, rapid almost imperceptible pulse, absence of cardiac impulse, muffled cardiac sounds, and low blood pressure.

3. Aspiration with a large needle may be attempted, the needle being introduced just under the left costal margin 2 cm. to the left of the midline and directed upward toward the left shoulder.

4. If this is ineffectual, prompt exposure of the heart may be effected by an incision paralleling the lower half of the left sternal border, with excision of the fifth costal cartilage, the fourth costal cartilage and part of the fourth rib, and the third costal cartilage:

(a) The pleura is displaced to the left.

(b) The exposed pericardium is incised between two traction sutures.

(c) The liquid and clotted blood are rapidly removed.

(d) A silk suture is placed in the thick muscular apex of the heart.

(e) The suture is then steadied by gentle traction.

(f) The hole in the myocardium is temporarily controlled by digital pressure.

(g) Sutures are applied paralleling the wound or at right angles to it, depending on the ease with which the heart's important blood vessels can be left out of the suture.

5. Do not attempt to grasp the edges of a ventricular wound in hemostats.

6. An auricular wound may be closed by applying clamps to the edges, drawing them together, and applying sutures.

7. The pericardium is closed loosely, with two or three widely spaced interrupted sutures so as to permit the escape of blood and inflammatory exudate into the mediastinal tissues or into the thorax, thus preventing a postoperative recurrence of the tamponade.

8. The operative wound in the thoracic wall should be closed securely without drainage.

INTRACRANIAL PRESSURE.

Increased intracranial pressure due to head injury requires careful observation and management.

1. *State of consciousness.*—The state of consciousness is the best clue to cerebral anoxia from pressure or contusion.

2. *Cerebral circulation.*—The cerebral circulation must be maintained if the patient is to survive. With a normal blood pressure reading of 120 systolic and 80 diastolic in the brachial artery, the arteriolar

pressure will be 32 mm. of mercury; the capillary pressure will be from 16 mm. to 20 mm. of mercury; and the spinal fluid pressure will be from 8 mm. to 10 mm. of mercury.

3. *Spinal fluid pressure and drainage.*—If the spinal fluid pressure rises above 15 to 20 mm. of mercury, the circulation in the capillaries will be suppressed unless a compensatory rise in blood pressure occurs. Spinal fluid pressure may be kept near normal by careful spinal drainage through spinal puncture. Drainage of the spinal fluid must be done slowly, from 2 to 4 drops at a time, so as to prevent a shift in structures already displaced by hemorrhage or edema. Such a shift may produce a block at the incisura of the tentorium or at the foramen magnum.

4. *Siphon action of jugular veins.*—Elevate the head slightly to increase the siphon action of the jugular veins. Pressure should not be applied on the jugular veins if venous back pressure, capable of producing both hemorrhage and edema, is to be prevented.

5. *Nonreacting pupil.*—A dilated, nonreacting pupil may be the only lateralizing sign of increased intracranial pressure in the unconscious patient. Subtemporal decompression should be undertaken on the side of the dilated pupil for removal of clot and control of hemorrhage.

6. *Dehydration.*—Dehydration for increased cerebral pressure should be used cautiously if at all in the tropics, as most men when injured are likely to be already in a state of negative water balance.

ANESTHESIA.

Pentothal sodium.—Pentothal sodium intravenously is an excellent anesthetic in the hands of one who has had some training in anesthesia and who is cognizant of its dangers. It is exceedingly dangerous in the hands of the untrained.

1. Pentothal sodium is safer to use in a 2.5-percent solution than a 5-percent solution.

2. Pentothal sodium should be given slowly with particular attention to the respirations which are best followed by observing the to-and-fro movements of a wisp of cotton attached below the nostrils on the upper lip by a piece of adhesive.

3. Breathing must be maintained, and if it is suspended for more than from 20 to 25 seconds, artificial respiration must be begun immediately. Artificial respiration should not be abandoned as long as there is any evidence of a functioning heart.

4. Coramine, 10 cc., may be given as a remedy for apnea due to overdosage of pentothal sodium.

5. Picrotoxin may also be given, if available.

6. It is dangerous to combine a spinal anesthetic with intravenous pentothal sodium. The thoracic depressant action of the former when

reinforced by the respiratory depressant action of pentothal sodium may easily be lethal.

7. Morphine sulfate, $\frac{1}{4}$ grain, may be administered intravenously with excellent effect, but as it is also a respiratory depressant, great care must be exercised in administering it in the course of an intravenous pentothal or spinal anesthesia.

Chloroform.—Chloroform administered on a small open ether mask at the rate of 20 drops per minute is a good anesthetic in the tropics.

Ether.—Ether can also be administered with good effect in the tropics if the open mask is well surrounded by wet towels to prevent too rapid evaporation.

PENICILLIN.

1. In extensive badly contaminated wounds, in which gas gangrene or serious infection may be expected, penicillin when available should be administered both as a prophylactic and curative measure.

2. When fluid is aspirated from a chest soon after injury, the introduction of 50,000 units of penicillin into the pleural space may be helpful in preventing later empyema.

3. An established gas gangrene infection should be treated energetically with penicillin. In no way should this alter the necessary thorough debridement, wide open drainage, and the administration of sulfonamides and antigas serum.

TREATMENT IN PRESENCE OF MALNUTRITION.

Secondary closures of even clean-looking wounds are contraindicated in forward areas if the patient exhibits any evidence of malnutrition, because hypoproteinemia, lack of vitamins, and anemia incident to malarial infection or to hookworm or to other intestinal infestations will seriously impair healing.

For similar reasons skin-grafting in malnourished, anemic or febrile patients should be postponed until nutrition is improved and the temperature is normal.

GENITAL MANIFESTATIONS OF EARLY FILARIASIS

R. HARWOOD FOGEL

Commander (MC) U. S. N. R.

and

ROBERT W. HUNTINGTON, JR.

Lieutenant Commander (MC) U. S. N. R.

Almost any standard textbook that deals with tropical medicine will contain pictures of natives from various parts of the world displaying the huge scrotum of filarial elephantiasis representative of the late stage of the disease process. Very little has been written on the early signs, symptoms, and pathologic changes of filariasis.

Buxton (1) many years ago described a clinical entity for which he used the native term "mumu," which occurred in Europeans within a few months after arrival in a South Pacific island group and which he believed to be filarial. We have recently been stationed in this island group and have found mumu to be prevalent among Navy and Marine personnel after brief residence in this area and have had a part in the work which confirms Buxton's belief as to its etiology (2). The essential points were the finding of adult filarial worms in numerous biopsies from lymphangitic extremities and the demonstration of sensitivity to filarial substance in the vast majority of patients, together with persistently negative bacteriologic findings.

Careful students have told us that in India, the Virgin Islands and other places where filariasis is endemic, clinical manifestations have been seen only after many years of exposure. If it is true that acute filarial manifestations within a few months of initial exposure occur only in this island group where we were stationed, one would be forced to assume either that the filariae endemic to this archipelago were unusual in their pathogenic properties or that transmission was peculiarly effective. Buxton commented on the unusual facility for transmission provided by nonperiodic embryos and a day biting vector (*Aedes scutellaris*). Recent unpublished studies by Byrd and St. Amant likewise stressed the excellence of the mosquito vector in this area. It has long been a subject of dispute whether the filariae of these islands, with their nonperiodic embryos, should be classed as a species distinct from that of the *Wuchereria*, whose embryos exhibit nocturnal periodicity (3). It is not impossible that this profound physiologic difference might be associated with other important differences and further study is clearly desirable.

It must be emphasized that our opportunity for studying early filariasis was unique in that we were dealing with a large body of troops who, through military necessity, were intensively exposed to bites by infected mosquitoes. It is probable that their reactions were quite different from the reactions of those exposed during and after infancy. Due to the fact that these troops were in the field, it was necessary to hospitalize all who were not able to stand the rigorous life demanded in jungle warfare. Thus, many lesions were seen which would not have caused a native or European civilian to enter a hospital.

It is desirable to record our observations, since filariasis is no longer a disease of which the physician can afford to be ignorant. Prior to this war, filariasis concerned only a limited number of physicians since the disease is tropical or subtropical in its geographic distribution. Now there are many thousands of men stationed in areas of endemic filariasis and those who contract the disease are returned to the United States. The majority of these have genital manifestations; others may develop signs of the disease many months after resuming residence in this country. It is important to note that one of the most striking features of this disease is its tendency to repeated recurrence, therefore many physicians will have the opportunity to see it.

Despite authoritative statements to the contrary (3) (4) there is a widespread notion that the diagnosis of filariasis can only be made by the finding of microfilariae in the blood or aspirated fluids. We wish to emphasize that microfilariae have not been found in blood or tissue fluid of any of the American patients studied by us. A high percentage of adult natives in this area had microfilariae in their blood. The mosquito, *Aedes scutellaris*, was the principal vector.

Before discussing the genital manifestations it is well to consider certain general aspects of mumu or acute filariasis. Clinically and pathologically the lesions are of two kinds: (1) The persistent nodular lesion surrounding an adult worm or the remains thereof, and (2) the more diffuse transient lymphangitis, presumably a sensitization phenomenon due to a diffusible agent released from a worm which may be some distance from the lesion.

The majority of the manifestations of mumu can appropriately be classified as lymphangitis. In many, perhaps the majority of cases, there is involvement both of the genitals and of one or more extremities. In our experience this lymphangitis has not been associated with bacterial infection. Grace (6), who has had a wide experience with filariasis in British Guiana, believes that the acute funiculitis is sterile. It customarily pursues a retrograde (centrifugal) course; thus in the arm the process starts in the axillary or epitrochlear region and extends downward toward the hand. The lymphangitis is well

defined, the area being dull red, tense and edematous. As noted by Grace (7), "lymphangitis is not associated either with desquamation of the skin, vesicle, or bulla formation, or with softening and fluctuation of the satellite nodes." Our observations have been similar.

Patients with filariasis sometimes present swellings in areolar tissue which obviously are allergic in origin. These swellings probably are of the same nature as the "Calabar swellings" found in loiasis. Relatively small swellings on the forehead may be associated with intractable headaches. Urticaria, often of the "giant type", frequently is encountered. Serous conjunctivitis with photophobia is a common finding.

In the general physical examination, one should look for acute lymphangitis, indurated lymphatic cords in the arms, neck and thighs, and palpable cervical, axillary, inguinal, and epitrochlear nodes. The latter often are striking. Elongated, spindle-shaped inguinal nodes are characteristic.

Constitutional symptoms.—Fever and acute prostration seldom are encountered, even with angry-looking local lesions. In the acute phase, nausea, vertigo, headache, and blurring of vision may be marked. Chest pain is frequent and pleural friction rubs are sometimes heard. Muscle pain and spasm are common complaints. Albuminuria is not unusual, and mental depression is quite characteristic and may be severe (8).

The basis for the constitutional symptoms is threefold, including (1) systemic toxic effects, (2) "referred" pain and disability from the local lesions (most marked with testicular lesions), and (3) a young male's natural concern over his genital tract.

Pathologic findings.—We know of only two instances in which genital tissue has been available for examination. Michael (5) performed an autopsy on a man who had filarial funiculitis at the time of his death from coronary disease. The following are some of the more interesting findings of the necropsy. The swelling began abruptly in the iliac lymphatics and extended all the way to the testes. No anatomic obstruction could be demonstrated. No worms were found in the tissue and the histologic picture was essentially that of an allergic response to a diffusible agent. There was marked diffuse edema of all structures, with diffuse lymphocytic and eosinophilic infiltration, and nodular and perivascular aggregations of lymphocytes. Lymphatic varices with thickened walls were prominent. There was marked accumulation of spermatozoa in the epididymis, suggesting a functional obstruction, although no anatomic obstruction in the epididymis or vas deferens could be found.

The other tissue which was studied came from an epididymo-vasectomy performed by one of the authors. Unfortunately serial sec-

tions were not made, so it is impossible to determine whether or not a worm was present. The pathologic report on this tissue follows.

A small inflammatory nodule attached to the epididymis had been opened by the surgeon after excision. A Giemsa-stained smear of its contents showed mononuclear and polynuclear cells with no visible bacteria.

The section of the epididymis showed a marked edema and congestion with diffuse infiltration by mononuclear cells and eosinophils. A lymphoid nodule composed of cells of immature appearance surrounded a small blood vessel in the epididymis. Other small vessels showed some cuffing and thickening. (The patient had a negative Kahn and no history of syphilis.) Some of the small vessels had thrombi.

The vas deferens was greatly thickened by edematous, loose fibrous tissue. The mucosa of the vas deferens and epididymis was intact everywhere, the pathologic process being entirely vascular and interstitial.

We are convinced that biopsies of the spermatic cord and regional lymphatics are unjustified. Only one complete epididymo-vasectomy was performed in this hospital and this was done before the nature of the disease with which we were dealing was fully realized. Since the operation was not curative and did not give relief of symptoms, it was not believed that this type of surgery was indicated in other patients. Further study of the histopathologic conditions of genital filariasis must await autopsy material. Doubtless the findings in an extensive series would parallel O'Connor and Hulse's findings in Porto Rico (4).

Physical signs.—While these often are discouragingly persistent, quite frequently they are astonishingly transient. What is obvious and definite at one examination may be quite different 12 or 24 hours later. Considerable confusion will be avoided in recording the description of objective findings if frequent progress notes are made. When a patient is transferred from one station to another, the new medical officer must be prepared to accept recorded facts that may be quite different from those presented at the time of his examination.

The common physical findings in genital filariasis, as seen in our patients, are as follows: (1) Swelling and edema of the spermatic cord as it lies in the inguinal canal and in the scrotum; (2) orchitis or hydrocele; (3) epididymitis; (4) vasitis; (5) varicocele; (6) edema of the scrotal skin; and (7) inguinal adenitis.

The most characteristic finding is swelling and edema of the spermatic cord. This is also the earliest sign if it is looked for in one complaining of pain or discomfort in the inguinal region. This process is descending, retrograde, or centrifugal, depending on the terminology one prefers. It has its counterpart in the visible lymphangitis of an extremity.

A brief description of this process, as seen in the three hospital corpsmen who were stationed in the genito-urinary operating room or wards will make the picture clearer.

Since they worked in this department it was possible to follow the clinical development at almost hourly intervals in the early stages of their disease. With the onset of the lower abdominal pain palpation revealed normal spermatic cords. Within 12 hours there was palpable swelling high up in the inguinal canal. The examining finger could be inserted through the external inguinal ring without causing much discomfort to the patient. As the hours passed, the progress of the swelling could be palpated as it moved down the cord. Within 24 hours that part of the cord lying within the inguinal canal was greatly swollen and tender. It was difficult to pass the palpating finger through the external ring because of the swelling and tenderness of the cord. In the succeeding 24 hours a scrotal mass was visible and palpable. Similar observations were made on many other patients who were seen as out-patients in the genito-urinary department prior to their admission to the hospital.

A boggy, edematous consistency of the testes was one of the most characteristic and persistent findings. In the acute phase of an attack there was definite tenderness of the testes, although this was never as marked as in the more familiar varieties of orchitis. In some instances there was sudden development of a scrotal mass which did not transmit light. Attempted aspiration in eight such cases yielded a small amount of fluid similar to that obtained from frank hydroceles.

Aspiration was done in 18 cases of frank hydroceles. The fluid obtained varied in volume from 10 to 60 cc. It was amber in color. There was no flocculation present. Lymphocytes predominated in the cells found. In some instances eosinophils were numerous. *Microfilariae* were not found. In 11 of these 18 cases there was a rapid reaccumulation of fluid. It was our impression that the course was more chronic in cases in which aspiration was done than in those in which it was omitted. In a number of instances a persistent scrotal mass developed following several episodes of transient swelling. In most instances, although not in all, such masses transmitted light. At present it is impossible to estimate the percentage of cases in which such chronic masses will develop. Generally the mass is due to tissue reaction rather than obstruction and it disappears on bed rest.

In describing the physical findings of filariasis of the epididymis, one is confronted with the difficulty of differentiating enlarged from normal sized organs as there is only a personal standard of what is normal. From our experience in palpating many hundreds of suspected and proved cases of epididymitis due to filariasis it was concluded: (1) Epididymitis is present in some degree in all instances where the spermatic cord is involved; (2) after repeated attacks, there is definite thickening and fibrosis of the epididymis.

In the acute epididymitis of early filariasis, the epididymis was found to be enlarged, smooth, and soft. There was some tenderness, as was to be expected, but it was found in a surprisingly slight degree and was markedly different from the extreme tenderness seen in gonorrheal epididymitis.

In chronic epididymitis the epididymis is small and fibrotic. This condition is not peculiar to filarial epididymitis. There is one finding to which, although it is not constant, considerable significance is attached, i. e., a small shotlike lymph node that often is present where the vas deferens becomes distinctly palpable from the epididymis. This small sentinel gland persists for many months.

Unfortunately no data are available as to the incidence of sterility in filarial epididymitis and vasitis. The native population in our highly filarial area appeared relatively prolific.

In acute cases it was impossible to determine by clinical examination whether or not the vas deferens was swollen. The spermatic cords were too tender to permit much pressure. The swelling made such palpation as could be done valueless. In the chronic cases, it was possible to palpate the vas deferens which was firm and more fibrotic than a normal one.

The relationship of filariasis to varicosities is a question of considerable interest and importance. Clinically it was obvious in a considerable number of cases that varices appeared for the first time during and after an acute funiculitis. Our clinical observations were corroborated by pathologic data.

Lymphatic varices were unequivocally demonstrated in histologic sections from Michael's case already cited. Changes in blood vessels of the cord were noted in our case. It is likely, therefore, that a filarial funiculitis could cause either the appearance of lymphatic varices or the exacerbation of venous varices. It is of interest that, doubtless on account of mechanical factors, filarial funiculitis, like the ordinary venous varicocele, has a predilection for the left side.

Edema of the scrotum was one phase of the genital involvement that was particularly intriguing. When edema was present, it always was found on the side where the funiculitis existed. There was no apparent relation between the degree of scrotal edema and the degree of swelling of the cord. The regional lymphatic glands were not always enlarged when the scrotal edema existed. Scrotal edema usually disappeared within 72 hours after bed rest was instituted. There was nothing unusual in the edematous skin, per se; in severe cases it was pale, and in milder cases it was red. The swelling was usually found in the most dependent part of the scrotum. It pitted on pressure and returned to its former fullness within a short time. The response to contact revealed that the cremasteric reflex, although present, was sluggish.

Inguinal adenitis was present in many patients who had scrotal lesions, but was absent in some of those who had the most severe scrotal involvement. Often the adenitis was most marked on one side while on the other there was scrotal involvement. The evaluation of inguinal adenopathy in these patients was rendered difficult by the high incidence of epidermophytosis of the foot in this part of the tropics. However, from observation on patients returned to the United States, it is believed that the typical inguinal node of filariasis is elongated, spindle-shaped, and characteristic of the disease.

Differential diagnosis.—In the very acute stage and early in the process of swelling of the spermatic cord, right-sided lesions must not be mistaken for appendicitis. The pain may be deep in the right lower quadrant of the abdomen. It is constant in early filariasis but usually is referred to the testicle and cord. Nausea is present in both conditions. The white blood cell count seldom is high in filariasis. The important signs of appendicitis, local tenderness and muscle rigidity, are absent in filarial funiculitis. Muscle guarding may be present in filariasis. Our experience has shown the importance of emphasizing the fact that patients with filariasis are no less susceptible to appendicitis than are other groups. One should not hesitate unduly before doing an appendectomy in a filariasis patient.

Differentiation between funiculitis and hernia, both inguinal and scrotal, may present a diagnostic problem. Hernia, even when recent, is not tender to palpation. Acutely swollen spermatic cords are tender. The impulse on coughing is the all-important sign in hernia; this is absent in filariasis. When the patient is prone, the swollen spermatic cord of filariasis does not change its position.

Differentiation of filarial and nonfilarial hydroceles depends largely on the history.

A history of filarial involvement or of previous residence in an endemic area may aid in the differentiation between filarial and ordinary varicocele. The filarial varix is prominent throughout the length of the cord. It may appear, disappear and reappear spontaneously within a few days, and is not appreciably affected by a change of position from standing to recumbent. Palpation of the cord within the inguinal canal may reveal a thickened vas which cannot be separated from the cord.

Acute epididymitis of filariasis is distinguished readily from acute gonorrheal epididymitis. The history of a urethral discharge that suddenly ceased or became scanty, the fever and sweats, the excruciating local tenderness, the severe pain, and the hardness of the swelling, as seen in gonorrheal epididymitis, are all absent in the filarial type.

Chronic epididymitis of old gonorrhea, of tuberculosis, and of quiescent filariasis will have to be differentiated in all patients who consult

the urologist because of chronic pain in the epididymis. Here again the history is of greatest importance.

Treatment.—At present there is no drug that has been found efficacious. The list of those that have been tried includes the sulfonamides, tryparsamide, mapharsen, sodium thiosulfate, and potassium and sodium iodide.

Bed rest is important in acute swelling. A suitable scrotal support and application of an ice bag have been found helpful. The ordinary suspensory has proved relatively useless.

We believe that operations on hydrocele, varicocele, and hernia are contraindicated on patients who have, or may have had, active filariasis. Manipulation of the spermatic cord adversely affects the local filarial funiculitis. Experience forces us to be particularly emphatic with regard to varicocelectomies as we feel the justification of this operation is dubious at best. The most badly damaged spermatic cords seen by us have been in patients with mumu who underwent varicocelectomies.

Our small experience with x-ray to the inguinal regions with careful screening of the scrotum has not been particularly encouraging.

In order to avoid repeated infections, it is the policy to return the patient to a nonfilarial area.

SUMMARY

The clinical entity described by Buxton under the native term mumu has been found to be very prevalent among the American troops in the South Pacific island group of which he wrote. The genital manifestations of mumu are described with particular reference to pathologic changes, diagnosis, differential diagnosis, and treatment. Filariasis should be suspected in any patient with genital pain or swelling who has been in the South Pacific area.

REFERENCES

1. BUXTON, P. A.: Researches in Polynesia and Melanesia. An Account of Investigations in Samoa, Tonga, the Ellice Group, and the New Hebrides, in 1924, 1925. London School of Hygiene and Tropical Medicine, London, 1928.
2. DIXON, J. G.; HUNTINGTON, R. W., Jr.; and EICHOLD, S.: Filariasis in defense force, Samoan group. U. S. Nav. M. Bull. 41: 1240-1251, September 1943.
3. STROMG, R. P.: Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases. 6th edition. The Blakiston Company, Philadelphia. 1942.
4. O'CONNOR, F. W., and HULSE, C. R.: Studies in filariasis in Puerto Rico. Puerto Rico J. Pub. Health & Trop. Med. 11: 167-272, December 1935.
5. MICHAEL, P.: Personal communication.
6. GRACE, A. W.: Personal communication.
7. GRACE, A. W.: Tropical lymphangitis and abscesses. J. A. M. A. 123: 462-466, October 23, 1943.
8. ROME, H. P., and FOGEL, R. H.: Psychosomatic manifestations of filariasis. J. A. M. A. 123: 944-946, December 11, 1943.

ACUTE INFECTIOUS HEPATITIS

VICTOR W. LOGAN
Commander (MC) U. S. N. R.

Epidemic hepatitis, infectious hepatitis, and infective hepatitis are names now generally accepted for the disease formerly known as acute catarrhal jaundice. Current interest in this disease is indicated by no fewer than four editorials on the subject in both *The Journal of the American Medical Association* and the *Lancet* in the year 1943. Ford (1) states that its contagious nature was recognized in the eighth century when it was mentioned in correspondence between Pope Zacharias and St. Boniface.

In peacetime usually only isolated cases are encountered, although excellent descriptions of civilian epidemics have been given by Cockayne (2), Pickles (3), Newman (4), and Ford in England. Williams (5), in 1923, reported 700 cases in upper New York State in the winter of 1921-22, the year in which Hiscock and Rogers (6) noted 119 cases at Yale University. It has made its appearance in the wars of the last 150 years—22,569 cases in the American Civil War, with 161 deaths, and 5,649 cases in the Boer War. In the present war, Dietrich (7) and Voegt (8) discussed its occurrence in the German armies, while Van Rooyen and Gordon (9) and Cameron (10) described epidemics in British Army hospitals in the Mediterranean area. Simpson and his associates (11) reported 320 cases seen in 1942-1943 at a United States Naval base hospital in the South Pacific area, and Willard (23) on 750 cases in the same region.

Clinically, the disease has a prodromal stage of about one week, during which an almost complete anorexia is the most constant symptom, associated with malaise, headache, fever and chills, constipation, nausea and vomiting. In milder cases these symptoms may be absent or not recognized by the phlegmatic patient. In severe cases the prodromal stage may be so stormy that scarlet fever, pneumonia, or appendicitis is suspected. In some instances the prodromal stage subsides for a few days and then fever again appears, ushering in the icteric phase. During the last days of the prodromal stage the urine darkens. With the onset of jaundice, the more distressing symptoms of the early stage usually disappear and the patient feels better. Cases range in severity from anicteric to deeply jaundiced types, while some go on to acute yellow atrophy and death.

The average hospitalized patient has at least one day of acholic stools. The liver and less often the spleen may be palpable. Laboratory findings are those of hepato-cellular disease. Bile is found in the urine, the icterus index is elevated and the Van den Bergh reaction is biphasic. In severe cases liver damage can be assessed by the various liver function tests, and the serum albumin will be found reduced. Reduction in the prothrombin blood level will occur. The histamine wheal test is said to be useful in determining latent jaundice. No leptospirae are to be found in the body fluids. There is no leukocytosis, although there is usually a leukopenia with relative lymphocytosis.

The pathologic changes are most striking in the parenchymal liver cells and are not, as was formerly supposed, due to cholangitis or ascending infection of the bile ducts, or obstruction due to a mucous plug at the ampulla of Vater. Aspiration biopsy of the liver, developed by Roholm and Iversen (12) and used by Kofler (13) and Dible, McMichael and Sherlock (14), has shown that in epidemic hepatitis there is necrosis and autolysis of the hepatic cells, beginning at the centers of the lobules, and associated with monocytic infiltration of the portal spaces. The interlobular biliary ducts are not affected, and in no case was there evidence of catarrh of the common duct. These authors are agreed that the pathologic features of epidemic hepatitis are indistinguishable from the hepatitis following transfusion of whole blood and plasma, and that occurring after the injection of convalescent serum and yellow fever vaccine, and from the hepatitis of arsphenamine jaundice.

While the etiologic agent has not been identified, it is considered probable that it is a virus. Siede and Luz (15), in fact, claim to have cultivated a virus from the duodenal fluid of patients with epidemic hepatitis, growing it on chick embryo. This has not been substantiated by others. The disease has not been transmitted to animals thus far, unless we accept the statement of Anderson that he gave jaundice to pigs in 1937. Others have failed to infect pigs, mice, guinea pigs, horses, rabbits, monkeys, and to use Van Rooyen's language, "those obstreperous beasts, Abyssinian baboons." The baboons might have been less obstreperous had they not been injected with infective material in their testicles. The disease has, however, been transmitted to human volunteers by transfer of nasal washings taken from patients with yellow fever vaccine jaundice (Findlay and Martin (16)); by oral ingestion of duodenal juice obtained from infected patients (Voegt), and by the injection of serum and blood from such cases (Voegt, Cameron).

EPIDEMIOLOGY

The incubation period is apparently variable. Cockayne was convinced that he acquired the disease from a female house servant who

waited on his table, her jaundice having antedated his own by 4 days. Other cases of his seemed to show an incubation period of 4 to 5 days, and in this Glover and Wilson (17) concur. Other British observers give longer incubation periods, as Newman (29 to 31 days), Pickles (26 to 35 days), Booth (not less than 20 and not more than 40 days), and Ford's schoolchildren from 14 to 37 days. Williams' nurses came down with the disease within 8 to 10 days after the admission of a pregnant jaundiced woman to a maternity home. Rogers states "the length of the incubation period . . . we thought we found in 1921 [was] from three to nineteen days, averaging one week." Griffith (18) in the spring of 1943 observed an epidemic among nurses of the Presbyterian Hospital of Philadelphia, originating 52 days after the admission of a child with infectious hepatitis.

Among human experiments, the minimal period is less flexible. Cameron's volunteers came down with jaundice in from 1 to 6 months. He believes the minimal incubation time to be 32 days. The three volunteers whom Findlay and Martin infected from nasal washings, developed jaundice 28, 30, and 50 days after exposure. Voegt's experiment with humans infected with duodenal juice and blood serum led him to believe in a 4-week incubation period. Van Rooyen and Gordon state "the incubation period of infective hepatitis is 4 to 5 weeks."

On the other hand, post-vaccinal and post-serum jaundice, which are otherwise clinically indistinguishable from epidemic hepatitis, have much longer incubation periods. Morgan's and Williamson's (19) series following blood transfusions ranged up to 107 days. Probert (20) in his series, which followed measles convalescent serum inoculation, saw jaundice develop 78 to 83 days later. Findlay and MacCallum (21) reported incubation periods up to 120 days in the yellow fever vaccine cases, which has been confirmed by the United States Army (22).

The mode of transmission is suggested by the above facts. Droplet infection, close contact, and in rare cases the handling of secretions and serum by hospital and laboratory personnel are possible. Insects may play a part. The recipients of serum, blood, and plasma from donors who have had the disease are expectant victims. The epidemics are not of the explosive character which water and milk-borne epidemics manifest. No one has yet shown that the icterogenic agent is in the stool of patients, although it has been noted that epidemics of jaundice seem to follow those of dysentery. Immunity is said to be permanent after an attack of infectious hepatitis.

In reviewing the cases of jaundice admitted to the Philadelphia Naval Hospital in the year 1942-43, we were able to show some connection between the individuals of certain groups. In all there were

45 cases admitted among active service personnel in this series. The disease is almost unknown among our veteran patients.

The first case occurred while a ship's detail was being assembled and the crew were living ashore in temporary barracks. A radioman, first class, recently returned from the Coral Sea battle, was admitted on 5 September 1942 with a history of anorexia, malaise, epigastric distress, nausea, and fever of 1 week, and jaundice of 3 days' duration. On 18 September two seamen with jaundice were admitted from the detail. These men knew each other but did not know the radioman. Jaundice had appeared in one of them 15 days after the original patient became yellow, and in the other 13 days later. The next admission occurred on 28 September, and the final or fifth case on 21 October. So far as can be ascertained this was the end of the epidemic on this ship. The intervals between patients, using the dates of first appearance of clinical jaundice, are 13 days, 15 days, 13 days, and 23 days. No other ship contributed more than two cases to our series during the year. In no instance could any connection be found between these cases and yellow fever vaccine inoculation.

Between 28 March and 22 June 1942 eight hospital corpsmen belonging to our staff were admitted with jaundice. In no instance had these men worked on the gastro-intestinal ward where such cases were admitted. Other sources of contact with each other and with jaundiced patients were of course possible, as in mess hall, at entertainments, and in dormitory quarters. No cases of jaundice occurring in corpsmen are on admitting records either in the 3 months before, or after the dates given above, although in this period there were cases of jaundice in the wards from other activities.

The series began with a pharmacist's mate, third class, who, 3 days after his discharge for an apparent catarrhal fever, was readmitted on 28 March 1942, with jaundice. The disease ran the usual course and he was discharged on 20 April. At this time another pharmacist's mate, third class, noted that his skin was becoming yellow, but did not report this until 4 May when he had an icterus index of 70. The apparent incubation period in this case was 23 days. The remaining six corpsmen were admitted one at a time at intervals of 11, 16, 15, 4, 6, and 11 days, computing from the dates of visible icterus.

Several other persons showed evidence of contracting the infection by direct contact. On 27 March 1943 a WAVE officer was admitted to the hospital after a fellow officer worker, who had had jaundice "some months before," told her that she looked jaundiced. Seven days later a second WAVE officer, who worked in the same office, contracted jaundice. It seems more probable that these two young women were infected from the same source, rather than that one infected the other.

On 10 April 1943 an officer of a ship's detail was admitted with

infectious hepatitis. Sixteen days later his roommate came to the hospital with the same disease.

On 2 February 1943 an officer who developed infectious hepatitis was admitted to a double room in Sick Officers' Quarters already occupied by another officer. The latter was discharged to duty on 16 February 1943. He was returned to the hospital with jaundice on 20 March, 32 days after discharge, and from 32 to 48 days after exposure.

TREATMENT AND CONTROL

Essentially the same treatment for this disease as that used in cirrhosis of the liver is employed in this hospital. The patient is put to bed, given a high carbohydrate, high protein, and low fat diet. This is supplemented with massive oral and parenteral vitamins with emphasis on the B complex. Vitamin K is given daily by subcutaneous injection. Bile salts are given until the stool shows evidence of bile flow. For the more severe cases dextrose and plasma are given intravenously as indicated. There has been no opportunity to use the amino acids intravenously. In view of the newer concepts of the pathologic state which is characteristic of infectious hepatitis, it is no longer considered helpful to subject patients to the exhausting attempts of eliciting bile drainage by duodenal intubation. If this is done for diagnostic or prognostic purposes, it should be remembered that the secretions are highly infectious and laboratory personnel should be so warned in handling them.

The disease, being infectious and capable of causing epidemics with fatalities, should be treated with respect. It should be a reportable disease in all states. Patients suffering from the early stages of the infection should be isolated with the same precautions at least as those accorded to epidemic respiratory disorders. No one who has had jaundice within one year should allow his blood to be used for purposes of transfusion or plasma manufacture, nor should serum be collected from post-jaundice patients to be used for convalescent serum. The period of infectivity has been estimated as extending from the beginning of the prodromal symptoms through the first week of visible jaundice. Owing to the fact that there probably are carriers, and that during epidemics many cases fail to show visible icterus, control measures will remain unsatisfactory.

SUMMARY

1. Acute infectious hepatitis is of military importance, and can be expected to occur in epidemic proportions, both in this country and abroad.

2. A review of the literature is presented, with recent contributions to the histopathology of the disease by aspiration biopsy.

3. The incubation period is not yet accurately determined, but appears to be 30 days in most cases. An unexplained feature of the mode of transmission is suggested by an apparent 2-week interval between new cases in the course of epidemics.

4. A review of the jaundice cases at the Naval Hospital, Philadelphia, revealed several small epidemics. Contacts were traced in other cases.

5. The disease should be regarded as serious in view of its occasional fatal outcome and its infectiousness. Treatment is directed toward protecting the liver from further damage, by diet, intensive vitamin therapy, and by maintaining the blood protein level.

6. Isolation should be practiced during the first week of jaundice. The disease should be made reportable. Blood and its by-products should not be collected from patients recovering from infectious hepatitis.

REFERENCES

1. FORD, J. C.: Infective hepatitis; 300 cases in outer London borough. *Lancet* 1: 675-678, May 29, 1943.
2. COCKAYNE, E. A.: Catarrhal jaundice, sporadic and epidemic, and its relation to acute yellow atrophy of liver. *Quart. J. Med.* 6: 1, 1912.
3. PICKLES, W. N.: Epidemic catarrhal jaundice; outbreak in Yorkshire. *Brit. M. J.* 1: 944-946, May 24, 1930.
4. NEWMAN, J. L.: Infective hepatitis; history of outbreak in Lavant Valley. *Brit. M. J.* 1: 61-65, January 17, 1942.
5. WILLIAMS, H.: Epidemic jaundice in New York State. *J. A. M. A.* 80: 532-534, February 24, 1923.
6. HISCOCK, I. V., and ROGERS, O. F.: Outbreak of epidemic jaundice among college students. *J. A. M. A.* 78: 488-490, February 18, 1922.
7. DIETRICH, S.: Der sogenannte katarrhalische Ikterus und die Hepatitis epidemica. *Deutsche med. Wchnschr.* 68: 5, January 2, 1942.
8. VOEGT, H.: Zur Aetologie der Hepatitis epidemica. *München med. Wchnschr.* 89: 76, January 23, 1942.
9. VAN ROOYEN, C. E., and GORDON, I.: Some experimental work on infective hepatitis in M. E. F. *J. Roy. Army M. Corps* 79: 213-225, November 1942.
10. CAMERON, J. D. S.: Infective hepatitis. *Quart. J. Med.* 12: 139-155, July 1943.
11. SIMPSON, W. M.; POWERS, W. L.; and LEHMAN, R. G.: Acute infective jaundice at U. S. Naval base hospital —. *U. S. Nav. M. Bull.* 41: 1620-1623, November 1943.
12. ROHOLM, K., and IVERSEN, P.: Changes in liver in acute epidemic hepatitis (catarrhal jaundice) based on 38 aspiration biopsies. *Acta path. et microbiol. Scandinau.* 16: 427-442, 1939.
13. KOFER, W.: Hepatic puncture as practical and valuable clinical method. *Ztschr. f. klin. Med.* 138: 744, December 28, 1940.
14. DIBLE, J. H.; McMICHAEL, J.; and SHERLOCK, S. P. V.: Pathology of acute hepatitis; aspiration biopsy studies of epidemic, arsenotherapy and serum jaundice. *Lancet* 2: 402-408. October 2, 1943. *Abst. J. A. M. A.* 123: 1144, December 25, 1943.

15. SIEDE, W., and LUZ, K.: Zur Aetiologie der Hepatitis epidemica. *Klin. Wchnschr.* 22: 70-74, January 23, 1943.
16. FINDLAY, G. M., and MARTIN, N. H.: Jaundice following yellow fever immunisation, transmission by intranasal instillation. *Lancet* 1: 678-680, May 29, 1943.
17. GLOVER, J. A., and WILSON, J.: Extensive epidemic of catarrhal jaundice. *Lancet* 1: 722-725, March 28, 1931.
18. GRIFFITH, G. C.: Personal communication.
19. MORGAN, H. V., and WILLIAMSON, D. A. J.: Jaundice following administration of human blood products. *Brit. M. J.* 1: 750-753, June 19, 1943.
20. PROPERT, S. A.: Hepatitis after prophylactic serum. *Brit. M. J.* 2: 677, 1938.
21. FINDLAY and MACCALLUM: Cited by FINDLAY, G. M., and MARTIN, N. H.
22. Jaundice. Circular Letter No. 45, May 13, 1942. Office of the Surgeon General, U. S. Army.
23. WILLARD, J. H.: Acute infectious jaundice. *U. S. Nav. M. Bull.* 42: 1085-1088, May 1944.



DICUMAROL IN SURGERY

Clinical evidence shows that carefully controlled and individualized administration of dicumarol by mouth is effective in the prevention of postoperative venous thrombosis and pulmonary embolism. The drug has no effect on thrombosis or embolism that has already occurred. There is slight risk of bleeding in cases in which dicumarol is being administered but if this occurs it can be controlled by transfusion of freshly drawn citrated blood.—BARKER, N. W.: Use of dicumarol in surgery. *Minnesota Med.* 27: 102-106, February 1944.



SURGERY AND SULFATHERAPY

The fundamental factors in the treatment of contaminated wounds are the control of hemorrhage, the prevention of infection, the treatment of shock, and appropriate immobilization and dressing. Only one of these is in any way influenced by sulfatherapy. In the sulfa drugs we have a valuable adjunct to good surgery; under no conditions should they be regarded as a substitute for good surgery.—SMYTH, C. M., JR.: Use and abuse of sulfonamides in surgery. *Pennsylvania M. J.* 47: 446-447, February 1944.

POSTERIOR GONOCOCCAL URETHRITIS

DONALD H. PATTISON
Lieutenant (MC) U. S. N. R.

and
ROBERT A. BURHANS
Lieutenant Commander (MC) U. S. N. R.

Palouze has stressed the fact that chronicity in gonococcal urethritis may readily spell posterior urethral involvement. That this statement frequently holds true is borne out by experience at this Naval hospital where during the 18-month period from 1 July 1942 to 31 December 1943 inclusive, 60 patients who had chronic gonorrhea were encountered.

These patients, all robust young men between the ages of 18 and 32 years, had the following findings in common: (1) A purulent or mucopurulent urethral discharge positive for *Neisseria gonorrhoeae* on Gram's stain, or if no discharge was present, culture of urine and prostatic secretion on chocolate blood agar positive for *Neisseria gonorrhoeae*; (2) both glasses of a two-glass specimen cloudy; (3) a history of continuous treatment over periods ranging from 4 weeks to 8 months, usually consisting of multiple courses of sulfonamide chemotherapy; and (4) little, if any, local treatment. Five of the patients had acute or subacute epididymitis on admission. Five others had received courses of artificial fever in a hypertherm apparatus. In no case was there a clearcut history suggesting gonococcal involvement of a joint.

The prevalence of gonorrhea with its staggering number of man-days per year lost to the armed forces seemed to justify the presentation of the methods used in the successful management of the cases in this series. It is emphasized that the procedures described are in no way original; they represent the application of well-known but frequently forgotten principles. No special apparatus and no materials difficult to obtain were employed. Cases might be similarly managed in combat areas with only the bare essentials of a dispensary or sick-bay. At the time of this report the supply of penicillin was not large enough to permit its use in all cases of gonococcus infection.

Fifty-eight, or 97 percent, of the 60 patients who had chronic posterior gonorrhea were cured in 3 to 6 weeks of treatment, an average of 32 days per case. The criteria of cure which were satisfied in each

case were: (1) Cessation of discharge; (2) both glasses of two-glass specimens crystal clear for at least 5 days following cessation of all treatment; and (3) a negative culture on chocolate blood agar of the first urine and prostatic secretion taken 5 days after cessation of all treatment. It is realized that the cultures mentioned in criterion 3 cannot be made except in large medical establishments, but their availability here made an excellent check on criteria 1 and 2. No instrument of any description, soft rubber catheter or otherwise, was introduced into the urethra either as a therapeutic or as a provocative measure.

Two patients proved refractory to treatment and were transferred elsewhere for trials of penicillin therapy.

METHOD

1. The daily morning two-glass specimen of urine was examined grossly by the ward medical officer and the result recorded on the patient's chart. This provided an accurate picture of the progress of the disease and permitted the recognition of blood, pus, mucus or crystals, either phosphates, urates, or sulfonamide compounds, in either or both glasses.

2. Fifteen grains (1 gm.) of sulfathiazole every 6 hours was given in a 12-day course. When necessary, courses were repeated after a 5-day interim, usually using sulfadiazine.

3. Daily through-and-through urethrovesical lavage was employed, using 1,500 to 1,800 cc. of warm solution of potassium permanganate, 1:6,000, in increments of 100 to 150 cc. each (gravity method).

4. As soon as glass 2 was crystal clear, gentle prostatic massage for 2 minutes, three times weekly, was begun. This was performed by the medical officer only and served a twofold purpose: (a) As stimulation to prostatic circulation, and (b) as a mechanical removal of inflammatory plugs, which may become inspissated in the prostatic ducts, thus preventing adequate drainage of an infected focus.

5. Typhoid vaccine administered intravenously was used as described by Hand¹ as an adjunct to chemotherapy and lavage in cases in which glass 2 would not clear. This was not intended to be the counterpart of the more heroic use of artificial fever such as is provided with the hypertherm apparatus. The use of this vaccine in 10 cases resulted in a clear second glass, thus permitting subsequent massage.

6. Personal inspection of the urethral meatus by the medical officer excluded the presence of local causes of poor urethral drainage such as congenital pinhole meatuses, the wearing of constricting gauze bandages, and so forth.

¹ HAND, E. A.: Treatment of chronic gonorrhea with combined sulfathiazole and intravenous typhoid vaccine. U. S. Nav. M. Bull. 41: 1365-1369, September 1943.

7. Treatment, massages, and cultures were carried out personally by the medical officer and not relegated to hospital corpsmen, to the patients, or to others who do not appreciate the anatomy and physiology of the lower part of the urinary tract.

CONCLUSIONS

1. Sulfonamide chemotherapy, when used alone, gives poor results in treatment of chronic posterior gonorrhea.

2. Chronic gonorrhea should be considered as posterior urethritis until proved otherwise by microscopic examination of the sediment of the second glass of a freshly voided two-glass specimen.

3. In the vast majority of cases, chronic posterior urethrophrostatitis will respond to sulfonamide chemotherapy, careful, gentle, local treatment, and massage. Intravenously administered typhoid vaccine is a valuable adjunct in stubborn cases.

4. No special apparatus or unusual preparation, other than that usually present in a dispensary or sickbay, is necessary. If chocolate blood agar cultures are not available, a longer period of observation of the two-glass specimen is obviously required.

5. The importance of gentleness, thoroughness and personal performance of all diagnostic and therapeutic procedures by the medical officer himself cannot be overemphasized in the successful management of posterior gonococcal urethritis.



EFFECTS OF PROLONGED CONTINUED FEVER

The continued fever of a prolonged illness interferes with the patient's ability to take food and fluids. The rate of catabolism increases, body tissues are broken down more rapidly, the glycogen store in the liver is more and more depleted, and protein destruction is accelerated. The demand for these substances together with minerals and vitamins (particularly C) becomes greater, and unless supplied promptly, the patient loses considerable weight and soon becomes exhausted. The ability of the body to resist infection is lessened and as a result, the rate of bacterial growth is often increased with a spread of the infection to other areas. The increased toxemia has a depressing effect upon the bone marrow with a faulty maturation of both red and white blood cells. There is an ultimate fall in the number of functionally active phagocytes in the peripheral blood and a decrease in the total red cell count. The same toxemia may affect the glomerular epithelium of the kidneys so that its permeability is increased and albumin loss begins.—PRICE, A. H.: General treatment in prolonged illness. Harper Hosp. Bull. 2: 16-18. January 1944.

TREATMENT OF CEREBROSPINAL FEVER WITH PENICILLIN

A PRELIMINARY REPORT

DAVID H. ROSENBERG

Lieutenant Commander (MC) U. S. N. R.

and

PHILIP A. ARLING

Lieutenant (MC) U. S. N. R.

In vitro studies have demonstrated the marked sensitivity of the meningococcus to the action of penicillin. However the efficacy of penicillin in controlling meningococcic infections in man has not been definitely determined (1).

Of the 31 cases of cerebrospinal fever constituting the basis of this report, 22 were proved to be meningococcal in origin. In 6 of these patients meningococci were cultivated from the blood. Of the remaining 9 patients the clinical picture and findings in the spinal fluid were characteristic of meningococcal meningitis, but the stained smears as well as cultures of the spinal fluid and blood revealed no organisms. Twelve of the thirty-one patients were comatose on admission; 11 were semicomatose. The initial spinal fluid cell count ranged between 66 per cubic millimeter, in a fulminating case of meningococcemia, and 50,100 per cubic millimeter, the average for the group being 12,300.

TREATMENT

Rammelkamp and Keefer (2) have shown that penicillin administered intravenously does not appear in the spinal fluid. Injected intrathecally (3), penicillin is slowly absorbed from the subarachnoid space, and in patients with meningitis may be detected in the spinal fluid 24 hours later. Keefer and his coworkers (1) advocated both the intrathecal and parenteral use of penicillin in the treatment of meningitis. However their experience with meningococcic meningitis was limited to only five patients, and the amount of penicillin administered was not recorded.

Our method of treatment has varied somewhat in different patients, and may need to be revised in the future as our experiences multiply. Nevertheless the most satisfactory plan was as follows.

The initial diagnostic lumbar puncture was performed in the usual

manner. If cloudy spinal fluid was obtained, the spinal canal was drained and 10,000 Oxford units of sodium penicillin, dissolved in 10 cc. of isotonic saline solution, were slowly introduced into the subarachnoid space. In seven patients 15,000 Oxford units, dissolved in 15 cc. of isotonic saline solution, were injected intrathecally, but this practice was abandoned because of increased symptoms and signs of meningeal irritation.

The first two patients treated received penicillin intrathecally every 12 hours until recovery appeared certain. From our observations on these and subsequent patients, it was apparent that, except perhaps in the fulminating cases of cerebrospinal fever, penicillin was sufficiently effective when given at 24-hour intervals and seemed to produce less meningeal irritation than when given every 12 hours. With each lumbar puncture the spinal canal was drained before penicillin was injected. Intrathecal penicillin was continued until clinical improvement, reduction in the temperature and pulse rate, and/or a decrease in the meningeal signs were manifest. The persistence of coma was regarded as an indication for further intrathecal therapy. Moreover it was found advisable to administer penicillin every 24 hours until the stained smears and cultures of the spinal fluid revealed no organisms.

Inasmuch as penicillin was injected intrathecally with each lumbar puncture without awaiting the results of the bacteriologic studies, this plan when followed was tantamount to giving an additional injection of penicillin after the spinal fluid became sterile. It was deemed unsafe in some cases to withhold therapy pending the results of the spinal fluid cultures. Further, in the severe cases in which coma lasted 48 hours or longer, penicillin was not discontinued until the spinal fluid was bacteria-free on 2 successive days. On the other hand, in 16 patients in whom the spinal fluid on admission showed no organisms in the stained smear, the clinical response following one intrathecal dose of penicillin was so prompt that further intrathecal therapy was not warranted.

Penicillin was also administered parenterally either by the continuous intravenous drip method at the rate of 5,000 Oxford units per hour, or intramuscularly in doses of 15,000 Oxford units every 3 hours, later reducing the dose to 10,000 Oxford units every 3 hours if improvement was satisfactory. A few patients, particularly those with the fulminating type of meningitis, received an initial dose of 40,000 Oxford units. For purposes of clinical study the individual total dosages of penicillin varied widely (20,000 to 900,000 Oxford units), the first patients treated receiving the largest amounts. It was soon observed that the total dosage could be reduced considerably without risk to the patient. Therefore, the general trend has been to use

smaller amounts in the less severe cases and up to 250,000 Oxford units in the fulminating types with meningococemia.

Because of lack of facilities the treatment could not be controlled by determinations of the amount of penicillin in the blood and spinal fluid. Instead, in an effort to note the clinical response, careful and frequent observations were made and the temperature, pulse, and respirations were taken every 2 hours.

In addition to specific therapy 3,000 cc. of fluids were given daily. When fluids were administered intravenously the penicillin was added directly to a 5-percent dextrose solution in dilutions of 25 to 40 units per cubic centimeter. Patients who were cyanotic on admission received oxygen therapy.

RESULTS

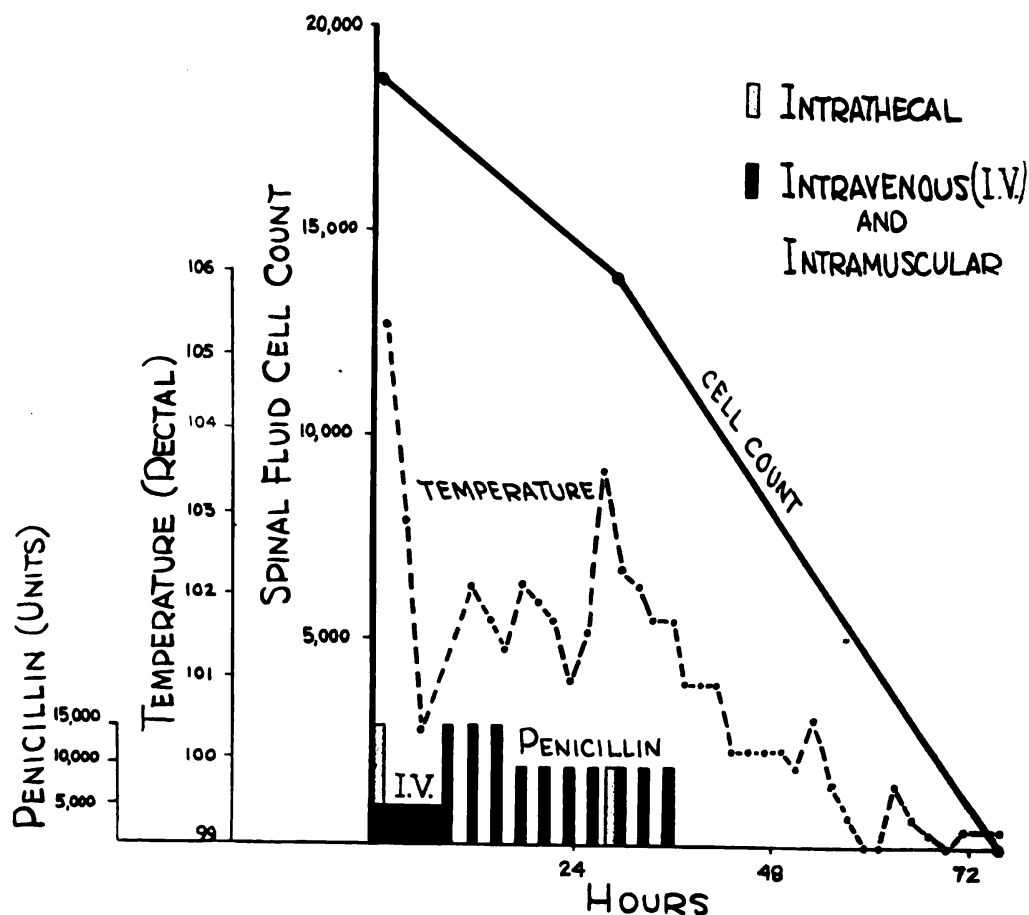
Thirty of the 31 patients treated with penicillin recovered. The one fatality occurred in a patient who was admitted in a moribund state, with clinical and bacteriologic evidence of meningococemia and well advanced meningitis. His temperature was 108° F., pulse rate 140 per minute and respirations 66 per minute. He received 12 gm. of sodium sulfadiazine parenterally in addition to 55,000 Oxford units of penicillin intrathecally and 380,000 Oxford units parenterally, but died 38 hours after admission. Necropsy disclosed suppurative meningitis, secondary hydrocephalus, and edema of the brain and lungs.

In the 30 patients who recovered, progressive improvement was noted soon after penicillin therapy was begun. In the majority there was an abrupt fall in temperature, and in 10 of these the temperature returned to normal in 24 to 48 hours. In some a low-grade intermittent fever (100° to 100.2° F. rectally) persisted until the fourth to the seventh day. In those individuals with a more prolonged febrile course, the fever was ascribed to one or more complications (to be discussed later), inasmuch as the spinal fluid had returned to normal. In a few of the first patients, a recurrence of fever was observed during the early period of hospitalization when penicillin therapy had been discontinued too soon. This was controlled by continuing penicillin intrathecally until the spinal fluid became sterile.

The pulse rate dropped rapidly to normal in the uncomplicated cases and appeared to be of prognostic significance. Signs of meningitis subsided completely in 2 to 7 days (average 4 days) except in the first two patients who received the largest amounts of intrathecal penicillin (100,000 to 125,000 Oxford units). In the latter, meningeal signs persisted for 9 days. In the majority of patients the spinal fluid returned to normal in 4 to 7 days. In the others only a slight lymphocytosis remained on the seventh to the tenth day of admission. On culture the spinal fluid in these patients was found to be sterile.

As a rule the patients were permitted out of bed on the eighth day unless there were complications. Several patients left their beds on the fifth day without permission but no untoward effects were noted.

An analysis of the amount of intrathecal penicillin administered to the 30 patients disclosed that 17 of them received only one injection, 4 (one comatose for 41 hours) received two injections, 5 received three



Showing the effect of penicillin on the spinal fluid cell count and temperature of a patient, age 19 years, admitted in profound coma. Meningococci were recovered from the spinal fluid. Blood cultures yielded negative results. A total of 20,000 Oxford units of penicillin were administered intrathecally, 40,000 Oxford units intravenously, and 115,000 Oxford units intramuscularly. The patient regained consciousness 41 hours after penicillin therapy was begun, and convalescence was rapid and uneventful.

injections and 1, five injections. In 23 of these cases the intrathecal dose was 10,000 Oxford units; in four, 15,000 Oxford units were given. Because of lack of information as to the potency and effectiveness of penicillin, the first 2 patients treated received totals of 100,000 and 125,000 Oxford units. Another patient with fulminating meningococcemia recovered with parenteral therapy alone. In this instance the spinal fluid on the day of admission was sterile and contained only 66 polymorphonuclear leukocytes per cubic millimeter.

The total amount of penicillin administered parenterally varied considerably in this series, as much as 900,000 Oxford units being given to one of the first patients. However, the last 22 subjects received total dosages ranging from 20,000 to 250,000 Oxford units. Of 5 patients who recovered and who on admission had positive blood cultures, in 2 the blood cultures were sterile after 40,000 Oxford units, and in the remaining 3 after 70,000, 90,000, and 250,000 Oxford units, respectively. Since the 250,000-unit dose was administered to a patient who had fulminating meningococcemia, it may conceivably represent the maximum dose required to combat the severe forms of meningococcemia, unless the infection is too far advanced by the time the patient is admitted to the hospital.

COMPLICATIONS

In six patients convalescence was prolonged by the presence of acute polyarthritides which was first noticed on admission but was unaffected by either intravenous or intramuscular penicillin. Aspiration of the knee joints of four patients yielded a yellow cloudy fluid, sterile on culture and containing 22,000 to 78,400 polymorphonuclear leukocytes per cubic millimeter. The ineffectiveness of 10,000 Oxford units of penicillin injected into the knee joint of one patient was not unexpected. In all instances the joints returned to normal.

Epididymitis, alone or with orchitis, developed in three patients. In one it appeared during the course of penicillin therapy, and in the other two it was noted 24 to 48 hours after this therapy had been discontinued. In all three instances it subsided spontaneously.

In three patients transient diplopia without cranial nerve involvement was observed. In two of the most severe cases encountered in this series, left sixth nerve palsy developed on the second day; in one of these it was followed 24 hours later by paresis of the right sixth nerve. In both restoration of function was ultimately complete. In one patient acute fibrinous pericarditis was found on admission and was uninfluenced by parenterally administered penicillin. Unilateral acute otitis media and acute tonsillitis complicated the convalescence in two instances. In one patient acute thrombophlebitis of the left saphenous vein occurred on the sixteenth day of admission; it was entirely unrelated to the site of parenteral therapy.

Untoward effects.—In those patients receiving intrathecal penicillin every 12 hours, as well as in some who were given intrathecal doses of 15,000 Oxford units, more severe and more persistent headache was noted, fever was prolonged, and the signs of meningitis subsided more slowly. Localized thrombophlebitis developed in two patients at the site of the continuous intravenous injection but was of minor significance. No other local or toxic effects were observed.

COMMENT

The effectiveness of penicillin in the treatment of meningococcic infections in man is demonstrated by the recovery of 30 out of 31 patients with cerebrospinal fever. Parenteral dosages ranging from a total of 40,000 Oxford units given over a period of 8 hours, to a maximum of 250,000 Oxford units over a 48-hour period, sufficed to sterilize the blood stream in five patients who had bacteriemia. Whereas the majority of patients in this series recovered following only one or two intrathecal injections of penicillin (10,000 to 20,000 Oxford units), in the more severe forms of meningitis larger amounts were necessary. As little as 20,000 Oxford units given intravenously over a 4-hour period, together with one intrathecal injection of 10,000 Oxford units, resulted in recovery in two instances. However the amount of penicillin required by different patients will by necessity vary with the number, type, and virulence of the organisms, as well as with the immunologic reaction of the host, and will be indicated by the clinical and bacteriologic responses.

Inasmuch as the clinical picture presented by the patients with bacteriemia was indistinguishable from that observed in many patients with negative blood cultures, it is contended that penicillin should be administered both parenterally (intravenously or intramuscularly) and intrathecally to all patients with cerebrospinal fever. It is of paramount importance to continue penicillin intrathecally until recovery is assured, observing the aforementioned criteria. However, from our observations it would appear that penicillin need only be administered parenterally during the first 24 to 48 hours of treatment, or for shorter periods in the milder forms of infection.

Although further observations are necessary to define more precisely the minimum adequate parenteral dose required to control the various forms of cerebrospinal fever, the dose would appear to lie within the range employed in those patients who recovered from bacteriemia (40,000 to 250,000 Oxford units). Studies along this line are now in progress.

SUMMARY AND CONCLUSIONS

1. Thirty out of 31 patients with cerebrospinal fever recovered following the use of penicillin. The method of treatment is described and the dosages employed intrathecally and parenterally are discussed.

2. Penicillin given intravenously or intramuscularly does not alter the course of such complications as arthritis, epididymitis, orchitis, or pericarditis.

3. Penicillin administered both intrathecally and parenterally is a safe, effective and highly potent agent in the treatment of cerebrospinal fever.

REFERENCES

1. **KEEFER, C. S.**; **BLANE, F. G.**; **MARSHALL, E. K., Jr.**; **LOCKWOOD, J. S.**; and **WOOD, W. B., Jr.**: Penicillin in treatment of infections; report of 500 cases; statement by Committee on Chemotherapeutic and Other Agents, Division of Medical Sciences, National Research Council. *J. A. M. A.* **122**: 1217-1224, August 28, 1943.
2. **RAMMELKAMP, C. H.**, and **KEEFER, C. S.**: Absorption, excretion and distribution of penicillin. *J. Clin. Investigation* **22**: 425-437, May 1943.
3. **IBID.**: Absorption, excretion and toxicity of penicillin administered by intrathecal injection. *Am. J. M. Sc.* **205**: 342-350, March 1943.



COLORS OBSERVED IN FLUORESCING TISSUES

White (bright) : normal breast tissue; scar tissue.

Blue (blue-white) : connective tissue. Blood vessels, nerves, and skin on cross section.

Blue (cobalt, in various tones) : fibroadenoma, cystic mastitis (small cysts).

Blue (Dresden with coarse white lines) : sclerosing adenoma.

Green (olive) : slight remains of absorbing hematoma.

Pink (dull) : necrosis.

Red (geranium, in spots) : bacterial invasion.

Red edges : superficial carcinomatous ulceration.

Black (or very dark brown) : blood; blood clot.

Orchid (faint and dull) : lining of cyst wall.

Purple (varying in intensity and frequently with fine, chalky, bright white lines) : carcinoma; where the cancer cells are tightly packed and where nuclei are especially hypertrophic and hyperchromatic, the purple color passes into tan, orange, and brown.—**HERLY, L.**: Studies in selective differentiation of tissues by means of filtered ultraviolet light. *Cancer Research* **4**: 227-231, April 1944.



ABDOMINAL PAIN IN HYPOGLYCEMIA

Patients with recurring abdominal pain require differential diagnostic procedures to rule out appendicitis, gastric or duodenal ulcers, cholecystitis, hepatitis, chronic pancreatitis, and other abdominal lesions. Patients in the age group of twenty to forty years, in whom operative procedures have been done with no relief or with recurrence of symptoms, should be studied for hypoglycemia. The author believes that the syndrome of hypoglycemia is far more common than is usually suspected since it has been possible to find ten patients in the short time of approximately one year of search.

Patients having recurrent abdominal pain in the absence of positive acute lesions of the abdomen should be studied for hypoglycemia as a cause of the pain.

Spontaneous hypoglycemia not due to pancreatic tumors can be controlled by a diet high in protein and fat but low in carbohydrates.—**BROWN, M. J.**: Hypoglycemia and abdominal pain. *Am. J. Surg.* **64**: 276-281, May 1944.

SPIROMETER METHOD FOR DETERMINING SPECIFIC GRAVITY OF MAN

FRANK J. GOUZE

Lieutenant Commander (MC) U. S. N. R.

and

ROBERT HAYTER

Lieutenant (MC) U. S. N.

Behnke, Feen and Welham ¹ state that since the density of the mass of body tissue exclusive of bone and fat is probably constant for healthy men, the amount of fat appears to be the main factor affecting the specific gravity of a person. A variation in the percentage of bone in relation to body weight, excluding excess fat, would not produce a deviation of more than 0.013 in comparable values. The specific gravity of the mineral substance of bone is about 3.0, adipose tissue 0.94, and all other tissue 1.060; the last figure is an approximation based on the specific gravity of blood and various other tissues.

Since the specific gravity of fat is relatively low, Welham and Behnke ² have proposed that men be classified as overweight on the basis of the specific gravity of the body, using a tentative dividing line of 1.060 for the elimination of the obese. Behnke, Feen and Welham point out that if a lean man weighing 140 pounds accumulated 60 pounds of adipose tissue, the corporeal specific gravity would be lowered from 1.082 to 1.035.

On the basis of various studies it has been estimated that a specific gravity of 1.080 indicates 10 percent of the body weight is excess fat, 1.062 indicates 20 percent is excess fat, and 1.036 indicates 33 percent is excess fat.

A more extensive discussion of obesity and its relation to specific gravity may be found in an excellent review by Behnke.³

Divers who are obese are more susceptible to bends than those who are lean, for nitrogen is 5 times as soluble in fat as in water. Therefore it is worth while to determine the specific gravity of diving applicants

¹ BEHNKE, A. R., Jr.; FEEN, B. G.; and WELHAM, W. C.: Specific gravity of healthy men; body weight ÷ volume as index of obesity. J. A. M. A. 118: 495-498, February 14, 1942.

² WELHAM, W. C., and BEHNKE, A. R., Jr.: Specific gravity of healthy men; body weight ÷ volume and other physical characteristics of exceptional athletes and of naval personnel. J. A. M. A. 118: 498-501, February 14, 1942.

³ BEHNKE, A. R., Jr.: Physiologic studies pertaining to deep sea diving and aviation, especially in relation to fat content and composition of body. (Harvey lecture) Bull New York Acad. Med. 18: 561-585, September 1942.

who are heavy. In general, an applicant whose specific gravity is below 1.050 is too obese for diving; one whose specific gravity is between 1.050 and 1.060 probably should be rejected unless he is muscular and otherwise promising, e. g., intelligent, emotionally stable and highly recommended. Furthermore, since diving requires more than average strength and endurance, it is desirable not to reject heavy but rugged men who might be eliminated if judged by the standard height-weight tables.

At the Deep Sea Diving School, Navy Yard, Washington, D. C., Welham determines the specific gravity of diving candidates who appear to be too fat. It has been found that inspection alone is not always an accurate method of deciding if a man is too fat for diving.

Method with spirometer.—The barometer is read and the temperature is taken from a thermometer attached to the spirometer. The subject undresses and is weighed, preferably with an accurate balance scale. He then applies a nose-clip and enters the water. To make breath-holding easier he takes several deep breaths; if desired, deep breaths of pure oxygen may be taken from a mask. He holds a deep breath in his lungs and gently lowers himself into the water. As the upper half of the body is more buoyant than the lower half, he floats vertically. The observer tells him to blow out small amounts of air; after each expiration the observer notes whether or not the crown of the head is still out of the water. When the crown floats just beneath the surface of the water, the end-point has been reached. The subject climbs part way out of the water and blows the remainder of the air into the spirometer, which has been placed at the water's edge. An inexperienced person needs about three trials to learn to reach an end-point. Three or four determinations with the spirometer will give air volumes that agree closely.

General principles of method.—From Archimedes' principle we know that the body is buoyed up by a force equal to its weight. This weight in kilograms equals the volume of displaced water in liters. Subtracting the lung volume that was necessary to float just beneath the surface gives the equivalent volume of the body.

The lung volume is the corrected spirometer reading plus the residual air. The spirometer reading must be corrected because (1) the temperature of the pulmonary air is different from the temperature of the spirometer air, and (2) the vapor pressure in the pulmonary air is different from the vapor pressure in the spirometer air. In the calculations the figure for the residual air volume is 1,450 cc. Behnke, Feen and Welham state that a value of 1,450 cc. can be used as a group average without appreciably altering the results; the error introduced thereby in the computation of specific gravity is ± 0.003 .

In summary, when the man floats just beneath the surface:

Weight of man in kilograms = equivalent volume of man in liters.

Equivalent volume of man in liters - volume lung capacity (corrected spirometer air + residual air) = equivalent volume of man with all air out of lungs.

Weight of man

Equivalent volume of man, all air out = specific gravity

Calculating corrections.—The first step in making the corrections is to calculate the volume of dry gas in the spirometer. Refer to table 1 to find the vapor pressure at the temperature of the room; divide the vapor pressure by the barometric pressure; multiply the spirometer volume by this quotient, and subtract the product from the spirometer volume.

The next step is to correct the volume of the dry gas for the change of temperature. Charles' law is used. Consequently the volume of dry gas in the spirometer is multiplied by the quotient obtained when the body temperature plus 273 is divided by the temperature of the spirometer air plus 273. Suppose the temperature of the spirometer air were 20° C.; the body temperature would then be 37° C. The numerator would be 37 plus 273, and the denominator would be 20 plus 273; $310/293 = 1.058$. When the volume of dry gas in the spirometer is multiplied by 1.058 the product is the volume of dry air in the lungs at balancing off.

The air in the lungs is, however, saturated with water vapor whose pressure at 37° C. is 47 mm. Hg. Assuming the barometric pressure is 760 mm. Hg., we find that 47 divided by 760 gives 6 percent. Therefore 94 percent of the volume in the lungs is due to air and 6 percent is due to water vapor; thus the actual lung volume at balancing off equals the volume of dry air in the lungs at balancing off multiplied by $100/94$.

TABLE 1.—Vapor pressure of water*

Temperature °C.	Pressure	Temperature °C.	Pressure	Temperature °C.	Pressure
0	4.6	14	12.0	28	28.3
1	4.9	15	12.8	29	30.0
2	5.3	16	13.6	30	31.8
3	5.7	17	14.5	31	33.7
4	6.1	18	15.5	32	35.7
5	6.5	19	16.5	33	37.7
6	7.0	20	17.5	34	39.9
7	7.5	21	18.7	35	42.2
8	8.0	22	19.8	36	44.6
9	8.6	23	21.1	37	47.1
10	9.2	24	22.4	38	49.7
11	9.8	25	23.8	39	52.4
12	10.5	26	25.2	40	55.3
13	11.2	27	26.7		

* Handbook of Chemistry and Physics, 1940.

SAMPLE CALCULATION OF SPECIFIC GRAVITY

Weight (pounds).....	153.0
Spirometer reading at balancing off (cc.).....	2,390.0
Residual air (average).....	1,450.0
Temperature of room (centigrade).....	30.0
Temperature of body.....	37.0
Vapor pressure at 30° C.....	31.8
Vapor pressure at 37° C.....	47.0
Barometric pressure.....	760.0
1 liter of air displaces 1 kg. of water; 1 kg.=2.2 lbs.	
31.8/760=4.18 percent. 2,390×4.18 percent=110 cc.	
Volume of dry air in spirometer=2,390—110=2,280.	
Volume of dry air in lungs=2,280×310/303=2,332.	
47÷760=6 percent. 100—6=94.	
Actual lung volume at balancing off=2,332×100/94=2,481.	
2,481+1,450=3,931. 3,931 liters×2.2 lbs.=8.65 lbs.	
153.00—8.65=144.35=equivalent volume.	
Weight Volume	=specific gravity; $\frac{153.00}{144.35}=1.060$.

COMMENT

Satisfactory balancing off in the water can be done in a few minutes. Calculation of the results may seem tedious; but it is quickly accomplished when logarithms are used. With a large group of men the time spent on each man is shortened, for usually one calculation of the factors for the change in temperature and water-vapor pressure suffices.

This method has a sensitive end-point; a person who is balanced off will sink if he blows out only 30 cc. of air.

To determine the validity of this method the specific gravity of some of the subjects was checked by the method used by Behnke and coworkers. They found the weight in water by suspending the subject below the surface of the water on a line leading up to a spring scale. The results obtained by the two methods agreed very well; in no instance was the difference greater than 0.003.

SUMMARY AND CONCLUSIONS

1. Obesity and its influence on specific gravity are discussed.
2. It would be desirable to make wider use of specific gravity determinations in the selection of divers.
3. A method of determining the specific gravity of man by spirometry is presented. It is believed to be valid and accurate.

TOOTHACHE IN THE LOW-PRESSURE CHAMBER ¹

I. W. BRICKMAN

Lieutenant (DC) U. S. N. R.

Toothache sometimes occurs in persons with dental defects who make rapid ascents to altitudes over 5,000 feet. This is generally believed to be caused by the pressure resulting from expanding gas in a closed cavity. The occurrence of toothache in flyers is important because the pain may be so severe that the flyer is distracted or even incapacitated. Indirectly it calls attention to dental defects which should be corrected. There are few references (1) (2) in the literature to studies dealing with this problem; it seems worth while, therefore, to report the occurrence of toothache in flyers who were subjected to decreased barometric pressure in steel chambers under controlled conditions.

Observations were made of 2,300 aviation cadets and student officers. Each subject was required to make at least two simulated runs in the low-pressure chamber. In the first or so-called indoctrination run, ascent is made to 18,000 feet at the rate of 5,000 feet per minute, where the subject remains for a period of 10 minutes without the use of additional oxygen. At the end of this period the subject is supplied with additional oxygen by means of a mask, and ascent is made to 28,000 feet. In approximately 8 minutes, during which various observations are made, the subject is returned to sea level at a rate of 5,000 feet per minute. The purpose of this run is to acquaint the subject with the symptomatology of anoxia and to give him instruction in the use of oxygen equipment.

About two weeks later the subject is given another run in the chamber in which, using additional oxygen, he ascends to 35,000 feet at a rate of 5,000 feet per minute. He remains at this height about 40 minutes. During this time, pulse rates are recorded at regular intervals and various tests are given. At the end of this period further ascent is made to 40,000 feet where the subject remains for 10 minutes, after which he is returned to sea level. Each subject is furnished with a log sheet on which all symptoms and experiences are noted. If toothache is experienced, a record is thus kept of the onset, duration, intensity, and character of pain.

¹ From Dental Section and Oxygen Indoctrination Unit, United States Naval Air Training Center, Pensacola, Fla.

The reduction of barometric pressure produced experimentally in the low-pressure chamber is strictly comparable to that encountered under flying conditions except that the changes occur more rapidly. Any other differences between the low-pressure chamber run and actual flight are probably of little or no significance in so far as toothache is concerned.

In all cases in which toothache occurred, the men were referred to the dental department where a thorough oral examination, including roentgenologic studies, was conducted. Before treatment, each subject who had experienced toothache was tested again to see if the pain would recur. Treatment was then instituted and the subject tested subsequently to determine its efficacy.

RESULTS

1. Toothache occurred in 27 of the 2,300 subjects, or 1.17 percent.
2. The pain occurred more frequently on ascent (74 percent) than on descent (26 percent).
3. The pressure altitudes at which pain was first noted are shown in the accompanying table. The table shows that toothache was provoked at the low altitude of 5,000 feet. It is also interesting that there is no one range of altitude at which onset of dental pain occurs more frequently than at another.
4. The character of the pain varied from a slight stinging sensation to a steady severe ache. It may be a momentary pain or one of several minutes' duration or it may persist until the subject has been returned to sea level where the pain usually subsides.
5. The tooth involved is not readily located but the area concerned is easily distinguished.

Pressure altitudes and pain

Altitude:	Number	Percent
5-10,000.....	5	18.5
10-15,000.....	4	14.8
15-20,000.....	5	18.5
20-25,000.....	5	18.5
25-30,000.....	3	11.1
30-35,000.....	3	11.1
35-40,000.....	2	7.4
Total.....	27	99.9

ETIOLOGY

The examination conducted after the run in the low-pressure chamber where toothache was experienced disclosed various dental defects as the principle etiologic factor. The total number of cases of toothache in this study, 27, was found to fall into the following groups, depending on the etiology:

1. In nine cases, recurrent caries under restorations was discovered. In none of these was a pulp exposure present.

2. Seven cases showed pulp exposure owing to caries or faulty cavity preparation.

3. In another group comprising four subjects, caries, not of a recurrent nature, was found to be the etiologic factor.

4. In four cases there were large silver amalgam restorations in close proximity to the pulp.

5. In one case there was no evidence of dental disease.

6. In one case a pulpless tooth was present.

7. In the remaining case, pain was probably due to a diseased maxillary sinus.

In the attempt to determine the probability of recurrence of pain before treatment was instituted, it was found that in every case in which there was pulp exposure, there was pain in each run made in the chamber. There were only two instances in which pain recurred, although no exposure was encountered.

The pain brought on by changes in barometric pressure may be attributed to the pressure of expanding gas on the nerve fibers in the pulp or in the dentinal tubules. This pressure is probably due to the inability of the air trapped in spaces, such as cavities and diseased pulp chambers, to move freely in and out of these areas as the barometric pressure changes. This phenomenon may be responsible for the occurrence of pain on both ascent and descent. During ascent it is increased pressure in the tooth due to reduced barometric pressure, and conversely, on descent the pain is probably due to the increased pressure from without as the barometric pressure is increased.

The etiology of toothache in flyers, as shown in this study, points the importance of the dental examination. These examinations should be thorough in all cases, but must be even more so when flyers are being examined. These examinations should include roentgenologic studies to determine the condition of restorations as well as the approximal surfaces of posterior teeth where so many cavities are overlooked during routine examinations.

TREATMENT

Treatment was the same in all cases in which dental caries with no exposure of the pulp was found. Those cases in which the dental pulp was exposed were divided into two groups: In one group treatment was in the manner to be described, and in the other group, the painful tooth was extracted. (At present, all posterior teeth with pulp exposures are extracted.)

1. Caries must be completely excavated and every effort made to insure against a recurrence of caries under a restoration.

2. Cavity preparations must be carefully and properly made. Care should be exercised in regard to the rapidity of burring when prepar-

ing cavities. Rapid burring generates heat which in turn may cause inflammation of the pulp. Rapid burring may also lead to exposure of the pulp during cavity preparation, especially in deep-seated cavities.

3. All deep-seated cavities should be lined with a zinc oxide and eugenol base, or a similar preparation, such as pulprotex base, to protect the pulp. Whenever this treatment was used, when the pulp was not exposed, there was no recurrence of pain in subsequent runs in the chamber.

4. A silver amalgam restoration should be inserted over the base.

5. Whenever practicable, teeth with exposed pulps, whatever the cause, should be extracted.

COMMENT

It may seem that the occurrence of toothache in flyers is not a problem, because of the low incidence of 1.17 percent. In aviation, however, especially military aviation, the success of the flight does not depend solely on one person, but on every member of the crew. If one man is distracted or incapacitated, even by a toothache, successful completion of the flight is endangered. This is sufficient reason to keep flyers dentally fit at all times. It is important that any probable cause for toothache be recognized and corrected early in order to prevent the occurrence of toothache in flyers.

In some instances, cadets and student officers are unable to complete the classification run in the low-pressure chamber during their training period because of severe toothache brought on by changes in barometric pressure.

The incidence of toothache occurring in flyers has been reported by Joseph and his coworkers (1) to be 1.2 percent. This percentage checks closely with that in the study reported here: 1.17 percent, which indicates that in a similar group of flyers the incidence of occurrence of toothache will be found to be constant.

The accompanying table shows that toothache may be provoked at altitudes as low as 5,000 feet and as high as 40,000 feet and at any altitude between these extremes, in almost equal percentages. This indicates that toothache in flyers is not a problem related only to high altitude but to all types of flying in which altitudes as low as 5,000 feet are encountered.

SUMMARY

1. Toothache due to changes in barometric pressure occurs in 1.17 percent of persons exposed to simulated runs in the low-pressure chambers.

2. The greatest percentage of toothaches in these cases is due to recurrent caries under old restorations and especially in cases in which exposure of the pulp has resulted.

3. There is no inevitability of recurrence of toothache at various high altitudes except in cases of pulp exposures.

4. The presence of any pathologic condition in or around the teeth is no indication that the person will experience pain during or after changes in barometric pressure.

5. Toothache will occur at altitudes as low as 5,000 feet.

6. Examination of aviation personnel should include roentgenologic studies with the use of bite-wing roentgenograms.

7. When a base is indicated in restoration of a tooth, the use of zinc oxide and eugenol is effective in preventing irritation of the pulp and subsequent inflammation.

8. Toothache occurring at various altitudes may be severe enough to reduce the aviator's efficiency and interfere with the successful completion of a mission; therefore, every effort must be made to eliminate any evidence of or probable cause of toothache in aviation personnel.

REFERENCES

1. JOSEPH, T. V.; GELL, C. F.; CARR, R. M.; and SHELESNYAK, M. C.: Toothache and the aviator; study of tooth pain provoked by simulated high altitude runs in low-pressure chamber. U. S. Nav. M. Bull. 41: 643-646, May 1943.
2. McCUNE, Q. A.: Physiologic aspects of high altitude flying, Lecture 18 in Lectures on War Medicine and Surgery for Dentists. Chicago Dental Society, Chicago, 1943. p. 87.



RAPID TEST FOR SULFONAMIDE IN URINE

The method is based on the color reaction in the presence of acids between crude cellulose (newspaper, matchsticks, pine shavings) and the arylamine group. Moisten a small area on a blank strip of newspaper with a drop or two of the specimen to be examined. Then place a small drop of dilute hydrochloric acid (1:4) on the center of the moistened area. The immediate appearance of a yellow to orange color indicates the presence of sulfonamide compound.

Paper made from refined pulp (for example, white bond) will not give the reaction.—HUBATA, R.: Simple rapid test for detection of sulfonamide compounds in urine. War Med. 5: 56-57, January 1944.

PROCESSING ACRYLIC DENTURES

COMPRESSION AND INJECTION METHOD

CLYDE SCHUYLER, D. D. S.

EDUARD GEORG FRIEDRICH

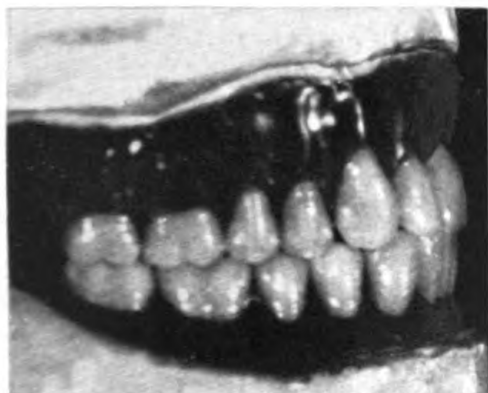
Lieutenant Commander (DC) U. S. N. R.

and

HOMER C. VAUGHAN, JR.

Lieutenant (DC) U. S. N. R.

Disturbances in occlusal relationship and opening of the bite of full dentures made of acrylic resin have been observed to occur in varying degrees. These changes in relationship take place even when the flask has been completely closed during processing. Osborne (1) and Taylor (2) have noted the disturbance and attributed it to over-packing and the accompanying displacement of the teeth in the mold.



1. Waxed cases prior to processing.



2 Change in cuspal relationship after processing upper denture in usual manner.

It was felt, however, that these changes were caused in part by the volumetric change of acrylic resin during polymerization (3) (4).

Two sets of upper and lower full dentures were set up on the Hanau anatomic articulator. The harmony and balance of the cases in centric, right and left lateral, and protrusive relations were perfected. A case in centric relationship before either denture was processed is shown in figure 1.

At this time permanent records of the occlusal surfaces of the upper and lower teeth were made by embedding the occlusal third of the teeth in soft plaster which was allowed to set. This record is referred to as the occlusal index.

The cases were set aside for a period of 2 weeks and the waxed dentures were again placed in their respective indexes. Each case fit its index, showing that no distortion of the wax model dentures had occurred during that period.

An attempt was made to maintain the constancy of as many factors as possible throughout this investigation; for example, none of the dentures was polished; thus any distortion could not have been attributable to polishing.

The casts on which the cases were originally waxed and processed were placed back on the articulator for comparison; thereby the original upper and lower cast relationship was preserved. Unless this procedure is followed and the finished dentures are brought back to



3. Change in cuspal relationship after both dentures have been processed by compression method. Bite opening as measured by amount of drop of incisal guide pin, from its original flush position, is 1 cm.



4. Relatively no change after processing lower denture by injection method. Actually there was some disturbance in cuspal relationship and bite opening as measured by drop of incisal guide pin of 0.5 mm.

the articulator on their original casts for comparison, the changes that we are attempting to point out and to eliminate will go unnoticed.

One set of dentures was processed by the compression method in flasks of conventional design. The cases were trial-packed with special attention to the complete closing of the flasks. The other set was invested in a Pryor injector flask, packed, and cured as recommended by the manufacturer.

The cases were processed one at a time: Either the upper or the lower was processed and then placed on its cast in the articulator for comparison with its mate as shown in figures 2 and 4. After both upper and lower dentures were processed, they were again placed on the articulator for comparison and evaluation of the changes that occurred in the fit of the dentures on the casts and the disturbance in the occlusal relationship.

The following method was used to estimate the amount of change in occlusal relationship: The top of the incisal guide pin was flush with the top of the articulator at the time the cases were waxed. The distance that the pin dropped in order to make contact with the incisal guide plane when the finished dentures were placed in centric position on the articulator gave a rough means of comparison of the amount of disturbance of occlusal relationship in each case.

CONCLUSIONS

From a comparison of the cases shown by the accompanying illustrations, the following observations may be made:

1. There is in all instances a change in the articulation as originally achieved in the wax model dentures. This is evidenced by the opening of the bite which was determined as previously described. In figure 2 the drop of the pin was roughly 5 mm.; in figure 3, roughly 10 mm.

2. The fact that the teeth no longer fit the occlusal index is further evidence of distortion. These cases (figs. 2 and 3) were processed by the compression method.

3. In figures 4 and 5 similar disturbances are observable in less degree, the bite opening being 0.5 mm. in figure 4, and roughly 1 mm. in figure 5, as indicated by the amount of drop in the incisal guide pin. These cases were processed by the injection method and came closer to fitting their original indexes.



5. Change in cuspal relationship after both dentures have been processed by injection method. Bite has been opened 1 mm., measured as described in text.

4. As may be observed by reference to the illustrations, the injection method of processing materially reduces the amount of displacement and distortion of the original setup (3) (4). This reduces the amount of grinding necessary to obtain the established occlusal relationship and comes closer to maintaining the original temporomandibular relationship.

5. It is believed that the injection method of processing should be adopted as standard procedure, so that there may be a more satisfactory denture service with greater comfort to the patient, and a reduction in the amount of time spent by the dental officer in making adjustments.

REFERENCES

1. OSBORNE, J.: Acrylic resins. Brit. Dent. J. 70: 289-296, April 15, 1941.
2. TAYLOR, P. B.: Acrylic resins; their manipulation. J. Am. Dent. A. 28: 373-387, March 1941.
3. PRYOR, W. J.: Methods of producing more lifelike dentures; including preparation and processing of acrylic resins. J. Am. Dent. A. 28: 894-902, June 1941.
4. WRIGHT, W. H.: Use of acrylic resins in dentures. J. Canad. Dent. A. 8: 267-274, June 1942.



PENICILLIN EFFECT ON CLOSTRIDIUM WELCHII INFECTION

Local penicillin therapy in *Cl. welchii* infection produced by intramuscular infection of mice has been investigated. The results obtained in over 1,100 penicillin treated animals have been compared with those obtained in simultaneous experiments with other chemotherapeutic agents. A small series of guinea pigs confirmed the results obtained with penicillin in mice.

Penicillin was of definite therapeutic value and decidedly superior to the other agents thus far investigated. The smallest dose of penicillin tried (5 Oxford units) protected as well as the largest dose of the most effective sulfonamide. Larger doses or repeated injections of small doses of penicillin protected 100 percent of the animals. Continued therapy gave better protection and resulted in smaller lesions at the site of inoculation than single doses of the drug; e. g., 7 injections of 25 units each (total 175 units) protected 96 percent of the animals, while 1 injection of 500 units protected 98 percent. Local administration of the drug was advantageous particularly when small doses were used. With larger doses, however, the drug reaching the lesions via the blood stream was equally effective.

Delayed institution of therapy was less hazardous with penicillin than with sulfonamides, but the percent survival was appreciably lowered by a delay of 3 hours. When treated animals died, the average period of survival was longer than after sulfonamide therapy.

As compared with the other agents tested, penicillin was much more effective in localizing the infectious agent, in minimizing the effects of toxemia and tissue damage, and in accelerating repair. The lesions at the site of inoculation healed within 10-18 days, as compared with 22-36 days with sulfonamides. There is still need, however, for additional therapy which will prevent initial rapid invasion by the microorganism with the production of early edema and late destructive lesions.

It is obvious that no chemotherapeutic agent, nor combination of agents will prove as effective alone as when combined with adequate surgical procedures.—HAC, L. R.: Experimental *Clostridium welchii* infection: IV. Penicillin therapy. J. Infect. Dis. 74: 164-172, March-April 1944.

FIXED ANTERIOR ACRYLIC RESTORATIONS

ALFRED J. KECK

Lieutenant (DC) U. S. N. R.

With the Assistance of

THOMAS W. DAVIN

Chief Pharmacist's Mate (AA) T, U. S. N. R.

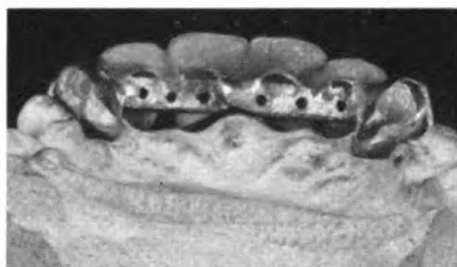
The restoration herein described could have been constructed by other methods than that advocated; however its low cost and good esthetic qualities made acrylic resin the material of choice in this particular fixed anterior restoration.

TECHNIC

1. Impressions were taken and study casts made (fig. 1). The central and lateral incisors were removed from the upper model in order to determine the procedure and to ascertain what the final result should be. It was decided that a fixed bridge was indicated to restore normal function and improve esthetics.



1. Cast of teeth before extractions.



2. Palatal view of framework.

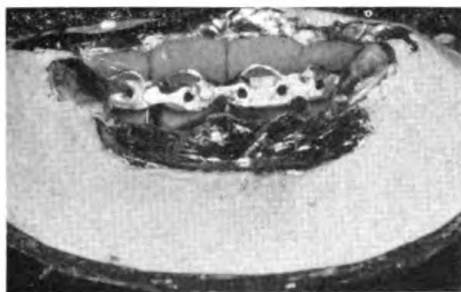
2. The diseased central incisors were extracted. The lateral incisors were also extracted because it was evident that it would be impossible to get the desired esthetics owing to the large space caused by the extraction of the centrals and the mechanical difficulties presented by their retention.

3. The left and right cuspids were prepared for three-quarter crowns. The preparations allowed fully for strength and esthetics, and included a pin in the cingulum of the abutment teeth for added retention. The three-quarter crowns were constructed by the indirect-direct technic. During the wax manipulation, strips of rubber dam

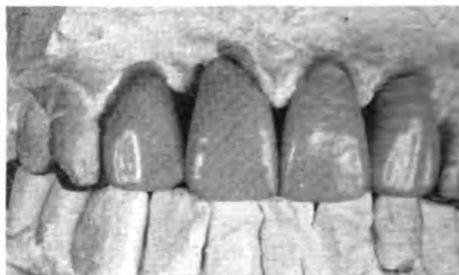
were used to pull the margins into place. Sandpaper disks were used to help remove excess wax in the final trimming. This is done in the same manner as in burnishing gold during the fitting of a gold restoration.

4. With the crowns in position, a plaster impression was taken, and the bite and shade were determined.

5. A bar was cast and soldered to the three-quarter crowns. The bar was perforated at intervals, and loops of gold were soldered to it for greater strength and retention of the acrylic material (fig. 2).



3. Close-up of framework.



4. Selected acrylic teeth ground into position.

6. The framework was tried in the mouth and checked for fit and retention (fig. 3).

7. Stock acrylic teeth were selected. Four centrals of different sizes were necessary in order to fill the space esthetically. The teeth were ground into proper position and waxed into place. The space to be filled was too large for esthetic accommodation of stock facings, regardless of arrangement (fig. 4).

8. The case was flaked and the wax boiled out.

9. The acrylic of a similar shade was packed into the case and cured.



5. Anterior view of finished case.



6. Palatal view of finished case.

10. When the case was finished and polished, it was inserted in the mouth for preliminary corrections. Occlusion and contour of teeth were changed as required.

11. The patient was permitted to wear the uncemented bridge for a few days in order to insure proper seating of the case. This is recommended as routine procedure in most cases of fixed bridge construction.

12. Further esthetic changes were made and overcompression of tissue was relieved.

13. The bridge was cemented into place (figs. 5 and 6).

The technic described has the following advantages: Strength; simplified selection of shade and mold by the use of stock teeth; comparatively low cost; restoration of function.

The poor repair factor is a disadvantage in the use of acrylic teeth.



HEPARIN AND DICOUMARIN

Heparin and dicoumarin may be administered together when both quick and prolonged action are desired. The use of heparin may be discontinued when the prothrombin time has been satisfactorily prolonged by dicoumarin. The combination of these two drugs produces no incompatibility. Constant emphasis must be placed on the danger of hemorrhage. In case of hemorrhage transfusions of fresh whole blood or plasma are indicated. It offers almost immediate safety from dicoumarin bleeding by replacing absent prothrombin.—DAVISON, F. A.: *Synopsis of Materia Medica, Toxicology, and Pharmacology*. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. p. 663.



REFRIGERATION EFFECTS ON TISSUES

From an analysis of the available clinical and experimental material many of the advocated advantages of refrigeration in infection, shock, traumatic injuries, vascular occlusions and reconstructive extremity surgery seem untenable. It was hoped that refrigeration might preserve the vitality of many limbs suffering from these afflictions which would ordinarily have to be sacrificed. Bacterial growth is retarded by refrigeration but so, also, is the tissue response to inflammation, and on release of the cooling the inflammatory reaction may even be aggravated.—RICHARDS, V.: *Refrigeration anesthesia in surgery*. *Ann. Surg.* 119: 178-200, February 1944.

ENDOTRACHEAL ANESTHESIA FOR DENTAL AND ORAL SURGERY ¹

WILLIAM B. JOHNSON, JR.
Lieutenant Commander (DC) U. S. N.

and
EDWIN R. RUZICKA
Lieutenant (MC) U. S. N. R.

Endotracheal anesthesia in the form familiar to us today dates back to 1880. In that year William MacEwen, a surgeon in Glasgow, employed the technic to insure smooth anesthesia and to prevent aspiration of foreign material into the trachea during an operation for removal of a malignant growth at the base of the tongue. Endotracheal anesthesia was used only occasionally thereafter because of the difficulties arising in inserting a tube into the trachea. Intubation was done blindly by the use of finger methods and individually designed aids, such as intubating forceps. These methods were difficult and many failures occurred. In 1913 Chevalier Jackson described a method of laryngoscopy for anesthetists.

Endotracheal anesthesia when used in cases of multiple extraction of teeth, with alveolectomy or other necessary procedure to prepare a mouth for dentures, has been instrumental in returning men to duty from 4 to 6 weeks sooner because of more rapid tissue repair, absence of infection, and the completion of the procedure in one operation.

ADVANTAGES

1. The primary advantage of endotracheal anesthesia in oral and dental surgery is freedom of airway. Intubation assures a free airway, whereas the most frequent cause of difficulty and danger in administering inhalation anesthetic agents is respiratory obstruction. If spasm of the larynx should occur with the tube in place, it will not interfere with respiratory exchange.

2. The aspiration of blood, mucus, vomitus, pus, and foreign bodies, such as fractured teeth, into the trachea is prevented.

3. Intubation also enables the anesthetist or operator to remove material from the bronchial tree by suction through or alongside the endotracheal tube.

4. Not the least important advantage is that the anesthetist may be removed to a distance from the operating field and still retain complete control of the patient. This point is of technical value in all dental and oral procedures in which general anesthesia is used.

5. Finally this type of anesthesia enables the oral surgeon to complete the procedure unhurriedly even in the face of untoward complications.

DISADVANTAGES

1. The disadvantages of endotracheal anesthesia appear in the act of intubation and management of the method when the tube is in place. Intubation is a difficult procedure and calls for the service of an anesthetist with special training, skill, and experience.

2. Intubation when performed with laryngoscopy requires anesthesia of sufficient depth to relax the mandible and depress the pharyngeal and laryngeal reflexes. Such depth of anesthesia is often not necessary for dental and oral surgical procedures in which endotracheal anesthesia is desired. In the series of cases cited here, however, little anesthetic agent was required once the endotracheal tube was in place: 120 cc. of ether has been the maximum amount used, with the time of operation varying from 30 to 90 minutes. The endotracheal tube is connected to the anesthesia machine by the circle filter method with carbon dioxide absorption. The patients are in a light stage of anesthesia at the end of the operative procedure and many react before leaving the operating room.

3. To secure the necessary depth of anesthesia for intubation, more time must be spent in induction of anesthesia. This time is considered justified in view of the improved operating conditions.

4. There is no evidence that endotracheal anesthesia increases the incidence of serious respiratory complications postoperatively. Minor respiratory complications, such as cough and slight soreness of the pharynx, may be increased, but this has not been evident in our cases. Indeed, the patients were not aware of having experienced intubation, whether the procedure used was nasotracheal, with the Magill curved rubber tube, or orotracheal, with the Woodbridge flexible metal tube.

EQUIPMENT

The equipment used consisted of Magill tubes, flexible metal tubes, an Eversole laryngoscope, intubating forceps, and angle pieces.

The laryngoscope used is of the U-type. It is light, with the batteries installed in the handle. This laryngoscope is believed to have advantages over the L-type instrument.

¹ Full credit is given for references to an excellent monograph by Gillespie, N. A.: *Endotracheal anesthesia*. Univ. of Wis. Press, Madison, Wis., 1941. This is recommended as the most complete work of its type to date.

A nongreasy, water-soluble lubricant jelly is used on the endotracheal tube. This not only facilitates the insertion of the tube but may reduce local irritation of the vocal cords and trachea.

The angle pieces are used to connect the endotracheal tube to the anesthesia machine.

PROCEDURE

Examination.—A laryngoscopic examination is made. The intubations were done by direct vision with the laryngoscope rather than by the "blind" technic. The value of inspection of the larynx became evident when two cases of cyst of the epiglottis were found during the laryngoscopic examination before intubation.

Anesthesia.—A smooth, easy induction of anesthesia is important in securing an uneventful intubation. Spraying the pharynx, cords, and trachea with a local anesthetic solution before intubation will diminish glottic spasm, and reflex coughing and breath-holding produced when the tube is placed into the trachea.

Intubation technic.—1. When the depth of anesthesia is sufficient, the patient's head is placed in the classical or amended positions described by Chevalier Jackson.

2. The laryngoscope is held in the left hand, inserted in the right angle of the mouth, and passed into the pharynx over the lower teeth with the tongue on the left side of the blade. The right hand insures that the lips are not caught between the teeth and the blade. The teeth must not be used as a fulcrum for the laryngoscope because they are easily injured.

3. The blade is passed along the dorsum of the tongue beyond the uvula and pillars of the fauces until the epiglottis is seen. Care is essential; it is easy to traumatize these structures.

4. The blade is inserted a little farther until its beak lies beneath the epiglottis.

5. The instrument is lifted vertically. No great force is necessary in this last maneuver to expose the glottis. When the epiglottis is lifted, the glottis comes into view behind it. The vocal cords should be open. The false cords show up as red folds placed like the sides of an isosceles triangle. The true cords are visible on the inner aspect of the triangle. They appear grayish-white.

6. If there is any movement of the cords, the moment of greatest abduction is chosen to pass the tube.

7. The flexible metal tube is passed outside the barrel of the laryngoscope rather than directly down the speculum. When the Magill tube is passed intranasally, the distal end of the tube may be used to direct the tube into the trachea. If this is difficult, intubating forceps may be used to grasp the tube in the pharynx and direct it properly.

The procedure described has been used in multiple extraction of the teeth and alveolectomies; in certain cases of unerupted and impacted molars; in excision of residual cysts of the maxilla and mandible, and in multiple fractures of the maxilla and mandible.

Multiple extractions.—Endotracheal anesthesia has been used in 26 cases of multiple extractions. In all cases postoperative pain and edema were notably absent. In most cases postoperative sedation was not required. Twenty-four hours postoperatively patients were up and about, in excellent condition. The tissues heal extremely rapidly and no infection has occurred in any case. Necessary surgery is completed in one operation. Patients are returned to duty in from 4 to 6 weeks sooner than was previously possible.

Multiple fractures.—Endotracheal anesthesia by the nasotracheal route has been used for cases of multiple fractures of the mandible and maxilla to secure complete relaxation and thus facilitate reduction. In these cases arch bars with rubber traction and when necessary the Taylor splint have been used. The nasotracheal tube is left in place until complete recovery from the anesthetic has occurred.

Postoperative precautions.—Postoperative precautionary methods include a portable suction machine kept by the patient's bed and a readily available pair of scissors. The suction is necessary in case of nausea and vomiting. The scissors are available to cut the rubber bands connecting the arch bars in case vomiting is excessive.

CONCLUSIONS

Endotracheal anesthesia in selected cases has materially reduced the length of hospitalization of patients having oral and dental surgery performed. This valuable anesthetic technic aids in the safety of the patient and insures freedom of access of the oral region to the surgeon; moreover the anesthetist may retain complete control of the patient at all times. Endotracheal anesthesia should not be used without good reason because of the inherent difficulty and danger of the procedure. A skilled anesthetist is essential.

"TRENCH MOUTH" ABOARD A UNITED STATES NAVAL AUXILIARY VESSEL

DION S. JANETOS

Lieutenant Commander (DC) U. S. N. R.

More than 175 cases of Vincent's infection (so-called trench mouth) were treated aboard a vessel among a personnel of 1,000 officers and enlisted men during an 8 months' stay in a British port. Routine smears were taken in every case and were positive for fusiform bacilli and spirochetes.

There was little Vincent's infection observed during our 6 months in American ports. There had been two or three cases a month, with response to systemic and local treatment. Shortly after arrival in a British port a rapid increase of the disease was noticed. It was appearing endemically aboard ship. Immediate measures were taken, therefore, to check its spread in the form of isolating and sterilizing gear, daily treatments in the dental office, proper home care and oral hygiene, and restriction of personnel with active cases to the ship until discharged as cured. Everyone became "trench mouth" conscious, visited the dental office for bleeding gums, and generally exercised strict oral hygiene.

TYPES OF VINCENT'S INFECTION OBSERVED

Three different types of the infection were prevalent, each with different clinical symptoms. Slightly different treatment was used for each type.

1. The most common type was the true Vincent's infection with sloughed gingiva and a strongly positive smear. Symptoms included bleeding, sore and tender gums, general malaise, temperature, bad taste, and fetid odor. In the advanced stage a pseudomembrane was present which was removed with a cotton swab dipped in hot sodium perborate solution. This type responded to treatment immediately.

A light scaling was done the first day and 7-percent chromic acid was deposited around the necks of the teeth between the beaks of cotton pliers. The patient was instructed to rinse his mouth four times daily with diluted hydrogen dioxide, holding the rinse in his mouth for 1½ or 2 minutes. On the second and third days a thorough scaling was done and the same treatment administered until the fifth or sixth

day when the condition usually cleared. The patient, however, was told to continue the rinses for a week or more.

2. The second type was primarily a gingivitis resulting from predisposing factors, such as avitaminosis, metallic poisoning, or syphilis, with a superimposed Vincent's infection. Symptoms included bleeding, inability to masticate because of pain, loss of weight (one patient lost 15 pounds), bad taste, and fetid odor. Melancholia and repeated daily complaining were characteristic. The gingivae in these cases appeared hypertrophic and tender with pocket formations around the teeth.

Treatment was systemic as well as local. Multiple vitamins as well as adequate diet improved the congested gingivae. Scaling was done. Gentian violet instead of chromic acid was applied to the gingivae. The area was completely dried with hot air and the gentian violet, held between the beaks of cotton pliers, applied. The area was then dried again. Usually this treatment was continued for 10 days. Meanwhile all teeth with cavities were restored. If the condition still persisted, third molars were examined for pericoronal flaps and carious or even mildly pitted crowns. In such cases the third molars were extracted, after which the infection cleared.

It appears here that chronic Vincent's infection may be eliminated by improving the resistance of the gums and treating pyorrhea pockets; by removing local irritants, such as calculus, and removing local foci, such as carious third molars or third molars with mildly pitted crowns; and correcting cavities and overhanging margins. This type of Vincent's infection, however, has a tendency to recur unless the patient exercises strict oral hygiene and maintains a good diet long after he has left the dental office.

3. A third type of Vincent's infection appeared in clean mouths. The chief symptoms were burning gums with an itchy feeling between the interstices of the teeth. Patients describe the sensation by saying that they feel like gouging out the spaces (interdental). Objectively, the gingivae in such cases are normal in color, texture, and appearance, but a smear for Vincent's infection is positive. Usually small pocket formations are present between the teeth. Chromic acid applied to the pockets brings about a permanent cure in two or three treatments. This type of the disease appears to be an initial infection of Vincent's organisms in a clean mouth.

SUMMARY

1. Three types of Vincent's infection were noted: (a) The classical Vincent's infection; (b) the type with underlying predisposing factors; (c) an infection in a clean mouth.

2. There is no specific treatment that is efficacious in all cases. To determine the presence of this oral disease, in addition to observing clinical manifestations and taking smears, it is necessary to consider personal hygiene, food habits, and the possible presence of other disorders.

3. Chromic acid is of value in treating Vincent's infection and if properly applied will not injure the teeth. Gentian violet has also been effective in some cases.

4. Strict oral hygiene is essential and in this cooperation of the patient must be had.

5. A vitamin-rich diet appears to be of value.



SULFONAMIDE INHIBITING ACTION OF PROCAINE

Procaine, in amounts ordinarily employed for local anesthesia, may be absorbed into the circulation in sufficient concentration to exert a definite inhibiting effect on the action of sulfonamide drugs that may be present in the blood.

Infection introduced into an area which has been infiltrated with procaine may become established locally in spite of the continuous presence in the body of bacteriostatic concentrations of sulfonamide drugs.

It is desirable to use local anesthetic drugs other than p-aminobenzoic acid derivatives for infiltration when performing exploratory punctures of potentially infected areas. Procaine, or similar anesthetics of the p-aminobenzoic acid series should also be avoided in extensive operative procedures on patients having severe infections in which rapid and effective action of sulfonamide drugs is essential.—PETERSON, O. L., and FINLAND, M.: Sulfonamide inhibiting action of procaine. *Am. J. M. Sc.* 207: 166-175, February 1944.



NONABSORBABLE SULFASUXIDINE IN EXTENSIVE BURNS

During the past year, the nonabsorbable sulfonamide, sulfasuxidine, has been used in a series of extensive burns as the bacteriostatic agent and has been found to facilitate earlier multiple grafting operations. The cases have had total third-degree burns of from 20 to 45 percent of the body surface according to Berkow's tables. Up to 25 gm. of sulfasuxidine have been dusted on the granulating areas and then a pressure dressing of boric acid ointment applied.

Under this regimen the patients have never shown any toxic effects and repeated blood concentrations have always been zero. Those who ran rather high temperatures have had noteworthy reduction in fever. The method has been decidedly easier on the patients than some treatments, as the dressings are not changed for periods of from four to eight days. The granulation tissue has become and remained clean enough for multiple transplantation of large split grafts, without the loss of any grafts.—TENNISON, C. W.: Use of nonabsorbable sulfasuxidine in extensive burns. *Surgery* 15: 332, February 1944.

ANALYSIS OF PSYCHIATRIC PATIENTS TRANSFERRED TO THE UNITED STATES FROM AN OVERSEAS BASE

JAMES N. WILLIAMS
Commander (MC) U. S. N. R.

This report is based upon the study of psychiatric patients transferred from this dispensary to the United States during the past 18 months.

The histories are analyzed in order to give a clearer understanding of the background of each patient in this group, to emphasize the predisposing factors and to determine the conditions that precipitated the psychiatric disorder which made these individuals unfit for further service.

Only a very few of the entire group of patients saw enemy action of any kind so this can be eliminated from consideration. The factors of fatigue and exhaustion do not play a part as few of the patients were subjected to any physical discomfort prior to admission to this dispensary. Out of our entire group there were six patients who were in combat with the enemy prior to transfer to this dispensary and the experiences resulting from combat were believed to be precipitating factors in the psychiatric disorder in this small number.

Age.—The ages of these patients range from 17 to 48 years with an average of 26.7 years (table 1). The largest number of patients in any group was 7 (21 years of age) and more than half of the patients were in the age range of 17 to 24 years (ratio 34:54).

Birthplace.—The patients in this group gave as their birthplaces 22 states and 2 foreign countries. The larger number of patients were reared in cities and were accustomed to the variety of interests afforded by larger cities. The two patients born in foreign countries came to the United States when young and made their homes in the northern United States.

Home conditions.—During the examinations a careful inquiry was made into the home conditions during the childhood period of each patient to ascertain the presence of conflicts in the home, the stability of the parents and the degree of parental guidance given. Such factors as security, attention and congeniality in the home were considered important during this developmental period. Upon the basis of these factors the homes were classified as good, fair, and poor. It is not surprising to find that of this group, 25 men were from homes that were definitely classified as poor, based upon the above standard with little

consideration given the actual financial status of the family. The homes of 20 of these patients were classified as fair and only 9 as good. It is realized that this arbitrary classification is open to question and further investigation may reveal factors that would cause a change of opinion, but the results obtained would not alter the ratio of the group.

TABLE 1.—*Age groups*

Age	Number	Age	Number	Age	Number
17.....	2	24.....	3	32.....	3
18.....	3	25.....	2	36.....	1
19.....	6	27.....	3	38.....	1
20.....	6	28.....	1	39.....	1
21.....	7	29.....	2	41.....	1
22.....	5	30.....	1	45.....	1
23.....	2	31.....	2	48.....	1

TABLE 2.—*Birthplaces*

State	Number	State	Number	State	Number
Alabama.....	1	Maine.....	2	Pennsylvania.....	9
Connecticut.....	2	Massachusetts.....	8	South Carolina.....	2
Florida.....	1	Michigan.....	3	Texas.....	1
Georgia.....	1	Nebraska.....	1	Virginia.....	3
Indiana.....	1	North Carolina.....	1	West Virginia.....	2
Iowa.....	1	New Jersey.....	1	Wisconsin.....	2
Kansas.....	1	New York.....	3	Foreign.....	2
Kentucky.....	3	Ohio.....	2		

Education.—The education of this group varies widely from grade school to college and a clearcut separation cannot be made. Some of the patients attended high school for 1 or 2 years and this overlapping would cause confusion if this were listed as simply high school education. Similarly the same situation exists with those who attended college for periods of less than 1 year. It was found that only 14 of this group completed high school and that 6 attended college for 1 year or more. The remaining 34 patients received less than a high school education and of this number 18 had less than an eighth grade education.

A consideration of the education of this group of patients gives helpful suggestion when further analysis is made and is an aid in understanding the individual. The 34 individuals who revealed less than a high school education were not feeble-minded as there was only one such case diagnosed and other factors are needed to explain why these individuals failed to continue in school. There are two important conditions, other than feeble-mindedness, that are responsible for early discontinuance of school. One is a poor home situation and the other a personality disorder. The first is obvious from the description of the homes of these patients and the second will be substantiated by the psychiatric diagnosis.

Adjustment in civil life.—The patient's adjustment in civil life prior to enlistment in the service could not be accurately determined as the history was obtained entirely from the patient. The standard used in obtaining some idea of past adjustment consisted of evidence of difficulties in school, if any, work-record, whether the patient changed jobs frequently or had difficulty in obtaining work, antisocial conduct, interest in activities other than work, and social attitude.

Using the above factors the adjustment of this group was divided into good, fair, and poor. There were 8 patients classified as good, 21 as fair and 25 as poor.

These figures are rather surprising in that less than half supposedly were poorly adjusted in civilian life. This can be explained only by the fact that all the history was obtained from the patients with no verification possible. If additional history could have been obtained from members of the families of these patients, it is possible that a larger number would be designated as poor.

Diagnosis.—The psychiatric classification of the patients is listed in table 3 and the Navy nomenclature is used. The majority are classified as constitutional psychopathic states. Although this is not descriptive of the condition in all instances, it does indicate that the disorder is characterized by emotional instability and inability to adjust properly in any environment.

The next largest number of patients had psychoneuroses. There were a few psychoses in the group. The duration of the psychiatric disorders could not be accurately determined as it was necessary to depend upon the history obtained from the patient. In the larger number of patients in this group, the detailed history obtained would certainly indicate that they were always poorly adjusted. Several gave a history of previous treatment for various disorders.

The schizophrenic individuals apparently were in a state of partial remission upon enlistment and then an exacerbation occurred when they were confronted with duty away from the United States. It is realized, however, that the rapid psychiatric examination necessary when a large group of men is sent to a base for training could not possibly detect all the abnormalities.

TABLE 3.—*Diagnoses*

Diagnosis	Number	Diagnosis	Number
Psychosis, schizophrenia (hebephrenic).....	4	Psychoneurosis, anxiety type.....	4
Psychosis, paranoid type.....	1	Psychoneurosis, hysteria.....	1
Psychosis, unclassified.....	1	Psychoneurosis, post-traumatic.....	1
Psychosis, manic depressive.....	2	Psychoneurosis, compulsive type.....	3
Constitutional psychopathic state, emotional instability.....	26	Psychoneurosis, situational neurosis.....	2
Constitutional psychopathic state, paranoid personality.....	1	Epilepsy.....	1
Constitutional psychopathic state, inadequate personality.....	3	Chronic alcoholism.....	1
		Somnambulism.....	2
		Feeble-minded with psychosis.....	1

To obtain the information contained in this report required many hours with each patient and the use of various methods, other than direct interview. It is interesting to note that three patients in this group had previously received bad conduct discharges from the Navy and after the lapse of years were allowed to enlist again.

Physical condition.—The physical state of this group of patients was good with few exceptions, and there was no evidence of any organic disease. Each patient had a complete examination consisting of physical, neurologic and laboratory tests, and when indicated spinal fluid examination, x-rays, and electrocardiograms were also made. There was no evidence of syphilis in this group; the history as well as serologic tests were negative.

There was no evidence of any neurologic disorder in this group of individuals.

Length of service.—The patients in this group had markedly varying periods of service, the longest 16 years and the shortest 6 months. The majority of patients (26) had less than 1 year of duty prior to admission to the dispensary and there were only 6 that had more than 2 years' duty.

The other important factor is the duration of foreign duty prior to admission to the dispensary. The longest period of duty was 18 months and the shortest 2 weeks. The majority of patients (44) had less than 10 months' duty outside of the United States and there were only 8 that had more than 1 year of foreign duty.

Marital status.—The larger number of patients in this group were unmarried (41) and there were only 13 married. Many of the patients who were unmarried said that they were engaged or intended getting married when the war is over. The married men with one exception denied any conflicts in the home and professed to be happily married.

SUMMARY

A group of patients from the Navy and Marine Corps were transferred to the United States because of psychiatric disorders which rendered them unfit for further duty at this base. An analysis was made of the important factors obtained from the histories of these patients to give a cross section of the life history and type of psychiatric disorder. These patients did not improve after intensive treatment of various kinds and it was necessary to transfer them to the United States.

The striking factor is the short period of foreign duty prior to hospitalization in an area free from enemy action and affording security. Apparently the wave of patriotism and excitement of training enabled these men to conceal their psychiatric disorders for a

short period but soon after leaving the United States there was an exacerbation. Homesickness did not play a major role in these disorders as these patients were not capable of making an adjustment in their own homes.

A study of these patients emphasizes the need for mental hygiene units located at boot training bases in the United States. These units could closely cooperate with officers responsible for preliminary training of the men. During preliminary training the men could be referred directly to such a unit for an interview and could be encouraged to report voluntarily to discuss any problem causing difficulty. Such a plan would facilitate adjustment in the Navy and prevent the precipitation of a psychiatric disorder in an unstable individual.

Frequently a longer period of training is needed for some individuals to adjust. When instability is not detected an individual sent to a foreign base for duty usually manifests psychiatric symptoms after a short period. This factor is illustrated in this group of patients and indicates that present screening is not adequate, especially where selectees are concerned.



CONTRAINDICATION TO PENTOTHAL ANESTHESIA

In the presence of certain types of injuries or conditions, the use of pentothal is hazardous. Among the most important of these are morphine overdosage, shock, infections of the neck, and liver damage. The danger of pentothal in operations on cervical or sublingual infections has been repeatedly emphasized and a number of deaths have been reported under such circumstances. Apparently, inflammation in the region of the carotid bodies and sinuses causes sensitization of reflexes arising there. Because pentothal anesthetizes the central nervous system more rapidly than the carotid sinus, these reflexes initiated by operative trauma exert a relatively more powerful inhibitory effect on the respiratory center, thus accounting probably for the notorious incidence of sudden death during such operations.

In general, pentothal should be avoided when the operative position or procedure may interfere with the airway or make artificial respiration difficult, as in operations that must be performed in the face-down position, in operations on maxillo-facial injuries or other injuries involving the airways. In intracranial surgery, pentothal is not considered a wise choice because such operations are usually long and are associated with great blood loss. Patients with severe burns seem to tolerate pentothal anesthesia poorly.—
News and comment: Pentothal anesthesia. Bull. U. S. Army M. Dept. No. 76, 1-3, May 1944.

A PSYCHOMETRIC PROCEDURE FOR SCREENING MENTAL DEFECTIVES ¹

HAROLD M. HILDRETH

Lieutenant H-V(S) U. S. N. R.

J. ARTHUR WHEELER, JR.

Lieutenant, junior grade D-V(S) U. S. N. R.

and

STANLEY B. WILLIAMS

Lieutenant, junior grade H-V(S) U. S. N. R.

This article describes a clinical psychometric method designed for the specialized procedure of screening at the Neuropsychiatric Observation Unit of the United States Naval Training Station, Sampson, New York. The demands of screen testing have resulted in the development of a somewhat new and different interpretation of the use of test items in mental measurement.

The customary aim of mental measurement has been to obtain a large sample of behavior from a variety of test situations in order to make an estimate of average mental ability. The purpose of screen testing is to predict from as few items as possible whether a particular person's ability is above a given minimum. In this there is no question of the complete evaluation of a person's abilities—his strong points, his weak points, his maximum range of capacity—but a question only of acceptability for satisfactory Naval service.

Customary or over-all mental testing requires testing conditions that often are not available. It requires that the subject be well motivated; that conditions and directions be standardized; that the person be relatively free from fear of the examiner and in rapport with the examiner. Screen testing, on the other hand, can and frequently must be administered under a variety of conditions, mental states, and time limits. The latitude permissible derives from the fact that the goal of screen testing is not the traditional I. Q. or mental-age score but the detection of supraminimal ability. This does not require a large and representative sample of a testee's behavior but only enough of a sample to establish whether ability is above a given level.

Tests that attempt to determine an I. Q., M. A., or other over-all evaluation include failures in the final score as well as successes in specific test items; the final score is thus attenuated by the failures.

¹ This material was prepared in August and September 1943.

Screen tests, by contrast, disregard specific failures because a subject is not penalized for failing a specific item if he is able to pass another item of equal difficulty. In the screen tests only discriminatory items are used; that is, items which are concentrated at the borderline level where the acceptable may be separated from the questionable recruit candidates. The probability has been empirically determined to be at least 99 in 100 that anyone who passes one of the tests has an I. Q. above 70 and therefore is not mentally defective. These test items require no elaborate testing conditions except that they must be administered individually; they can even be interpolated in the conversation of the interview. Even such brief and apparently casual tests have been shown to have an error of less than 1 percent.

It has been found that a few selective items may be arranged in a graded series (to be referred to later as the five-phase program), so that the examiner may quickly weed out the men who need more intensive examination. The saving of time is of practical importance, because a great deal of the screening has to be done on the "receiving line" during the final physical and mental reexamination of the recruits before they enter training. By the screen tests, in a few minutes it is possible to certify as acceptable a large number of recruits and thereby save more time for careful examination in the borderline cases. There is no short-cut method of examination in these cases. No man should be presented to the Aptitude Board (for consideration for discharge from the service) who has not been thoroughly and intensively observed and tested.

The actual program consists of a five-phase procedure which groups test items in five levels of intensity of testing, each successive level sampling more of the person's total abilities. These stages can best be described by following the course of a recruit through testing.

PRELIMINARY SCREEN TESTS

Phase 1.—The tests consist of brief oral questions, such as definitions, arithmetic problems, number-series and reading comprehension. Superficially similar questions have frequently been used by interviewers, but the battery of items used in these screen tests has been carefully selected and statistically validated (1). As a result, the tests, although brief, have predictive value. From a positive response to a single question, such as: "What does 'tolerate' mean?" the psychologist can predict that the recruit on further testing will prove to have a mental age above the Navy's minimum. The error of this prediction is statistically determined. If there is a negative response to the question, no prediction whatever may be made and no general statement of the recruit's intelligence is justifiable. All that is indicated by a negative response (failure) is the need for further testing.

Following a negative response to three or more of the screen test items, the recruit is sent to the Neuropsychiatric Unit where he undergoes the other four stages of the testing program. If a recruit passes this preliminary screen test, he is sent to training.

It is emphasized that the procedure described is not, strictly speaking, intelligence testing and is in no way a substitute for it. It is primarily a means of meeting a practical situation. It is a useful way of dividing incoming recruits into two groups, the acceptable and the questionable. At Sampson the questionable group has comprised about 10 percent of all those seen by the psychologist; thus a great deal of time is saved by this first phase. On further testing, this group is reduced in number. Many of the doubtful candidates are sent to training duty.¹

Phase 2.—In most cases phase 2 is administered in the neuropsychiatric ward. It consists of two paper-and-pencil tests from the Kent Battery: Arithmetical Reasoning and Easy Directions, each requiring 2 minutes' testing time. The two tests can be given and scored in 6 minutes. These tests have been described elsewhere (2) (3) (4) (5). They are used here as separate screen tests, apart from the complete Kent Battery. On the basis of 6 months' experience, certain critical minimum scores have been determined, which, if exceeded by a recruit, indicate acceptability and thereby obviate the need for more extensive testing. These minimum scores are: 17 points on the Easy Directions combined with 2 points on the Arithmetical Reasoning (raw scores); or 11 points on the Easy Directions combined with 3 points on the Arithmetical Reasoning (raw scores).

Less than 1 percent of all recruits who have exceeded the minimal scores have later been considered rejectable by the Aptitude Board. Although the Aptitude Board's decisions are based on over-all criteria, which fluctuate from time to time, they probably represent the best single estimate of service aptitude available at present. It is worth while to mention also that the distribution of scores made by rejected recruits shows a sharp break between 10 and 11 points on the Easy Directions test; many score 10 and below and only a few score 11 or higher. There is likewise a similar sharp break between 2 and 3 points on the Arithmetical Reasoning.

At present, if a recruit equals or exceeds the minimal score in the phase 2 tests, he is immediately sent to training, provided that the interview does not reveal any gross behavior disorder. If the recruit scores below the minimal level, he is carried on to phase 3 of the testing program.

¹A check on the effectiveness of the screening is the number of rejectable recruits discharged during their subsequent training period. In 5 months, these cases amounted to only two-tenths of 1 percent of all cases referred to the psychologists. This compares favorably with the number reported from stations where the longer Kent Battery is reported as used for screening "on the line."

Phase 3.—Phase 3 consists of the remainder of the Kent Battery; namely, the Revised EGY and the Verbal Opposites. Together these require from 5 to 10 minutes' examining time. Again, on the basis of accumulated cases, statistical analysis showed that if a man who had scored less than the minimal scores on the tests in phase 2 attains a score equivalent to 12 years' mental age (raw score 24) or better on the EGY, he will not prove to be rejectable by the Aptitude Board on grounds of mental deficiency. Likewise, if he scores 13 years (raw score 18) or better on Verbal Opposites, he will meet the Navy's minimal requirements. Similarly, if he scores a mental age of 10 or higher on all the tests of the Kent Battery, he is sent to duty. If he scores below these minimal levels, he is retained for further observation and is tested under phase 4 of the program.

Phase 4.—A fairly satisfactory judgment of intelligence level can be obtained by the use of three of the verbal sub-tests of the Wechsler-Bellevue Scale (Information, Arithmetic, and either Similarities or Comprehension) (6). These can be administered in about 20 minutes, and together with the Kent Battery comprise a fairly solid basis for predicting success of the recruit in Naval training.

Usually the recruit who is given these tests is the man who falls slightly below the criterion level on the Kent Battery. Not infrequently he will score high enough on the abbreviated Wechsler-Bellevue Scale for the psychologist to be sure that he meets at least the minimum standards. Such a recruit is sent immediately to duty without further testing. If he does not score higher, and therefore remains in the doubtful category, phase 5 is administered.

Phase 5.—Phase 5 is not rigidly defined. It consists of any one or all of the following tests: Complete Wechsler-Bellevue, Revised Beta Examination, Stanford-Binet, Otis Self-Administering Test, the Rorschach Ink-Blot test, and such other special tests as are clinically indicated. It is this fifth phase which requires so much of the examiner's time and which is necessary for a complete evaluation of a questionable case. Usually the complete Wechsler-Bellevue test is given. Every recruit who is brought before the Aptitude Board with recommendation for discharge for reasons of mental deficiency is given the tests in phase 5. This differs from the usual procedure in that it comes fifth in the "screening" program rather than first or second, in order to economize examination time.

CONCLUSION

It cannot be emphasized too strongly that such a five-phase procedure as has been described is only a tool at the disposal of the clinical psychologist. In using this objective instrument, he must exercise his experienced judgment. He must always evaluate test

data in the light of observed behavior and background, and, as every clinical psychologist knows, there are cases in which exceptions must be made.

The usual case history is taken of every recruit who reaches phase 2 of the program. Personality factors, language handicap, bizarre responses, and anomalous behavior disorders are detected in the case history interview. This serves as a check against test information.

REFERENCES

1. HILDRETH, H. M.: Single-item tests in psychometric screening. In preparation.
2. HUNT, W. A.; WITTON, C. L.; HARRIS, H. I.; SOLOMON, P.; and JACKSON, M. M.: Psychometric procedures in detection of neuropsychiatrically unfit. U. S. Nav. M. Bull. 41: 471-480, March 1943.
3. KENT, G. H.: Emergency battery of one-minute tests. J. Psychol. 13: 141-164, 1942.
4. Ibid.: Tentative norms for Emergency Battery. J. Psychol. 15: 137-149, 1943.
5. Ibid.: Written tests for clinic. J. Genet. Psychol. 44: 49-68, 1934.
6. RABIN, A. I.: Short form of Wechsler-Bellevue Test. J. Appl. Psychol. 27: 320-324, 1943.



CERTAIN "DON'TS" IN SHOCK THERAPY

First, do not use digitalis which not only is of no value but actually may be harmful. The heart in uncomplicated shock is not at fault, but rather the peripheral circulation. Second, do not administer epinephrine because it raises blood pressure. Epinephrine has been used experimentally as a method of inducing shock and pulmonary edema. Finally, omit stimulants such as caffeine and strychnine. They have no value in correcting the defects present in shock, and may make the patient unduly restless.

We feel that it is advisable to withhold all chemotherapy including all substances containing chemotherapeutic agents until the patient's urinary output exceeds 700 cc.; otherwise, toxic levels of the drug are to be expected. In oliguric patients attention should be directed first toward improving urinary excretion. When adequate output has been obtained, chemotherapy may be employed orally or parenterally, according to the patient's condition.—SEGAL, M. S., and AISNER, M.: Management of certain aspects of gas poisoning with particular reference to shock and pulmonary complications. Ann. Int. Med. 20 (O. S. 25): 219-227, February 1944.

STUDY OF ALBUMINURIA IN APPLICANTS FOR NAVAL ENLISTMENT

WILLIS A. MURPHY
Lieutenant (MC) U. S. N. R.

The purpose of this communication is to present data obtained from an analysis of 300 consecutive cases of albuminuria occurring in male applicants for Naval enlistment. The investigation covered the period from 16 July to 9 November 1943, during which time 9,994 men between the ages of 17 and 51 years were examined at a Naval recruiting station. For statistical purposes this number was divided into three age groups: 17-year group, 18 to 38 group, and 39 to 50 group. While the relationship of proteinuria to age, its seasonal incidence, and postural defects was noted, it remained our particular concern to separate the pathologic from the orthostatic type and to draw attention to a procedure by which such a distinction can usually be made.

Plan of study.—Each individual who showed albumin on the initial examination was given an appointment to report for further study and requested to carry out the following instructions.

1. Drink only small quantities of fluids up to 5 p. m. on the day preceding return to the station and omit all fluids after that hour.
2. Just prior to retiring empty the bladder.
3. Upon awakening in the morning and before arising from bed void into a clean bottle and bring this specimen to the station.

Four more samples were collected at the sickbay. The first was obtained immediately upon reporting; the second after 30 minutes in the recumbent position; the third after 10 minutes in the erect exaggerated lordotic position, and the fourth after 30 minutes in the sitting position. The applicant was directed to empty his bladder at each voiding. One thousand cubic centimeters of water were given prior to lying down and the entire procedure was closely supervised by a pharmacist's mate.

The urine specimens were all tested for albumin, using the heat and acetic acid method. The overnight specimen was centrifuged at high speed for 5 minutes and the sediment carefully examined for the presence of casts and cellular elements. If this urine was alkaline in reaction or had a low specific gravity, the applicant was asked to repeat the procedure another day for the reason that casts and red blood cells are not well preserved under these conditions.

No renal function tests were performed other than the determination of the specific gravity of the nocturnal sample which served as an index of concentrating ability.

Upon completion of these analyses the resting blood pressure (average of three readings) was recorded, the fundi examined for the presence of vascular changes, and the hemoglobin determined. Height and weight were charted and the presence or absence of lordosis was noted. In addition the applicant was thoroughly questioned as to the occurrence in the past or present of any manifestations of renal disease, and when indicated requests were forwarded to hospitals and dispensaries for transcripts of records of admission.

Results.—Two hundred fifty-five of the three hundred cases of proteinuria possessed the following distinctive features and accordingly were considered to be orthostatic in type.

1. Albumin was present only in the erect position and varied from a trace to grade 2 in quantity. It was entirely absent in the overnight specimen and also in the specimen voided after the recumbent and sitting position. Placing the subject in the exaggerated lordotic position caused it to reappear.

2. As a rule the urinary sediment contained only a few white blood cells. Red blood cells and casts were never seen in significant numbers.

3. Concentrating power was normal as shown by a specific gravity of at least 1.022.

4. The blood pressure was not elevated.

5. There was no history of renal disease.

The remaining 45 cases of proteinuria did not exhibit this distinctive pattern. Glomerulonephritis was presumed to be the underlying cause in 29 cases, essential hypertension in 7 and surgical disease of the genito-urinary system in 4. This gave a total of 41 cases in which the albuminuria was classified as pathologic in nature. There remained 4 cases in which the type of albuminuria was not determined.

Age incidence of albuminuria.—That orthostatic albuminuria occurs chiefly in youth is clearly illustrated in table 1 which reveals that in the 17-year-old group this form of albuminuria was 10 times more frequent than in the 18 to 38 group and was entirely absent in the group over 38 years of age. On the other hand, pathologic albuminuria occurred in all three age groups and actually accounted for all the patients seen above the age of 32.

TABLE 1.—*The incidence of albuminuria in the 3 age groups*

Age groups	Number of applicants	Number of orthostatic albuminurias	Number of pathologic albuminurias
17	4,517	232	26
18-38	4,248	23	11
39-51	1,229	0	4

Seventy-five percent of the individuals with this type of albumin had a normal body weight, 15 percent were underweight, and 10 percent overweight. The majority were above the average height. Postural defects were common, true lordosis or the lordotic posture being present in over 80 percent of the cases.

That there is a striking seasonal variation in the appearance of orthostatic albuminuria is shown in chart 1 which reveals the highest incidence to be in the summer months.

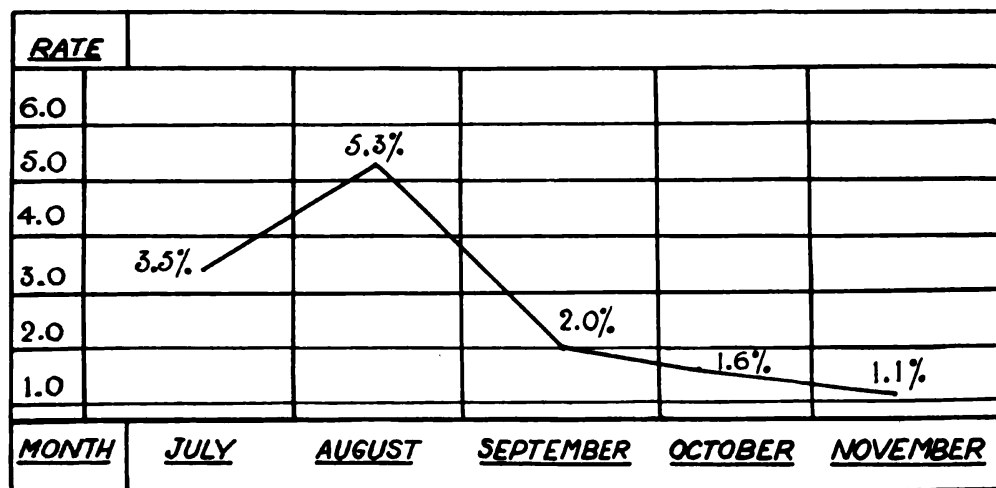


CHART 1.—Seasonal incidence of orthostatic albuminuria per 100 applicants.

Pathologic albuminuria group.—In all 29 cases in which the diagnosis of glomerulonephritis was made, albumin was persistent, usually heavy in amount and not appreciably affected by changes in posture. The urinary sediment in 29 instances contained an excessive number of casts. Microscopic hematuria was present in 21 cases. One-half the group had impairment of concentrating power. Elevation of the blood pressure was noted in 14 men, several of whom had hypertensive changes in the fundi. Low hemoglobin values were encountered in 4 cases. Both facial and peripheral edema were observed in 3 cases. Three applicants gave a past history of acute diffuse glomerulonephritis and 12 others admitted symptoms suggestive of renal disturbance.

The 7 cases comprising the essential hypertension group showed as a rule a moderate amount of albumin that tended to diminish on rest. The urinary sediment was normal. There was no impairment of concentrating power. Moderate to marked elevation of the blood pressure accompanied by hypertensive retinopathy was present in every case.

The 4 cases in which surgical disease of the genito-urinary system was considered to be present showed a mild persistent albuminuria in association with large numbers of pus or red blood cells in the urine. Casts were absent, concentration power was normal, and the blood

pressure was within normal limits. A history of lumbar pain and dysuria was obtained from two of the subjects. Another stated that he had observed intermittent bloody urine during the preceding 6 months. One applicant complained only of slight diurnal frequency.

The undetermined group.—This consisted of four cases found in the 17-year-old group in which no definite classification could be made. Repeated examinations revealed a mild albuminuria that was not affected by postural changes. No other noteworthy features were present.

SUMMARY

The incidence of albuminuria in this series of 9,994 men between the ages of 17 and 50 was 3 percent. Eighty-five percent of the albuminurias were designated as orthostatic, 13.7 percent as pathologic, and 1.3 percent as undetermined in type. Orthostatic albuminuria occurred almost exclusively in the younger age groups, no cases being discovered over the age of 32. The high incidence of lordosis and the seasonal variation were other noteworthy characteristics.

The distinction between the two main types of albuminuria can readily be determined if one bears in mind that in orthostatic albuminuria the albumin disappears on rest; the urinary sediment does not contain an abnormal number of casts and cellular elements; the blood pressure is not elevated; renal concentrating power is unimpaired; and there is no history of renal disease.



FACTS CONCERNING DICOUMARIN

Dicoumarin should be administered only when guided by repeated calculations of prothrombin time.

The effect on prothrombin time is proportional to amount of dicoumarin administered. Individual variations are found.

The oral administration prolongs prothrombin time, impairs clot retraction, and increases the sedimentation rate of erythrocytes.

Synthetic vitamin K has little or no effect on prolongation of prothrombin time resulting from dicoumarin.

The danger of hemorrhage from dicoumarin therapy serves as a constant emphasis for care in its use.

The action of heparin is not prolonged when given to dicoumarinized animals and heparin is not involved in the action of dicoumarin.

Sulfathiazole therapy has no effect on the effectiveness of dicoumarin.

Dicoumarin in proper dosage is apparently nontoxic.—DAVISON, F. A.: *Synopsis of Materia Medica, Toxicology, and Pharmacology*. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. pp. 662-663.

OCCUPATIONAL THERAPY IN A NAVAL HOSPITAL

HARDY V. HUGHENS

Captain (MC) U. S. N.

and

LEON O. PARKER

Commander (MC) U. S. N. R.

Patients who are discharged from Naval hospitals to duty should be able to resume their usual work, except in those instances in which the activity agrees to take a partially disabled man. The most practical criterion by which the medical officer can certify that a patient is fit for duty is for that patient to have done some form of work or gymnastic exercises or participated in athletic activities requiring similar activity to that of his duty.

This conditioning program should usually begin early in the patient's hospitalization and should be carried out only according to the orders of the patient's doctor who should prescribe its quality, quantity, and progression to suit the patient's needs. The convalescent from an acute illness, an injury, or operation benefits greatly by early very light activity while in bed. As he improves, the amount of physical activity or properly prescribed work is increased in proportion to his tolerance.

There are also the patients who claim they are disabled but who show no disabling findings upon examination. Such patients can best be handled by being observed under a prescribed work or exercise program. The patient may develop objective findings that will lead to a correct diagnosis, or he may find that he can condition himself to work and will cheerfully ask to be returned to duty.

In order to give a large number of patients who might be benefited thereby a work, exercise, and play program, the United States Naval Hospital at Aiea Heights, Territory of Hawaii, organized a department of occupational therapy. The results of the first 6 months' experience with this program were gratifying.

ORGANIZATION AND OPERATION

The occupational therapy department has as its head a medical officer who is directly responsible to the commanding officer through the executive officer. His duties are essentially administrative and after organization is effected, he needs to give only a small amount

of his time. At least one full-time hospital corpsman is required for about every 300 patients. In addition, qualified occupational therapists, civilian volunteers, carry on a program of arts and crafts for bed patients only.

It is necessary to have a conveniently located office for the department with sufficient desk, table, and file space, telephone and typewriter.

The department is divided into an arts and crafts division and an industrial division. Arts and crafts are utilized while the patient is confined to bed or is unable to walk to and from the ward. The industrial division replaces what is commonly known as the "outside detail." It utilizes the various industrial and maintenance departments of the hospital to furnish the work required for the treatment of the patient. After he has improved sufficiently to walk out of the ward he is given graduated work therapy to develop function either in general or in a specifically disabled part. This continues until the patient is fit for duty or has reached maximum hospital improvement. The various educational courses given on the patients' regular assigned stations of duty, which are provided by the educational office, must be mentioned because of their importance in the general program of conditioning men for return to duty.

The sole function of the department is that of therapy; namely, to see that the ward medical officer's prescription for work, exercise, and play is carried out to the benefit of the patient. The patient reports to work with a card of instructions specifying the type of work needed for his particular therapy, the amount of work and period of rest required, and warning against any type of work or activity that would be injurious to his health. The department is not responsible for the patient's productivity. It is responsible for keeping records of the amount of work done and the patient's response to the work. The hospital departments using the patient's services are responsible for teaching him the specific way the work is to be done, and the person in charge of the job on which the patient is working is held responsible for carrying out the instructions on the patient's work-card. It is the duty of the occupational therapy department to select a job for the patient that conforms strictly to the medical officer's orders for his work treatment.

If at sick call the medical officer finds that the patient needs heavier or lighter work, he requests the department to increase, decrease, or discontinue his activity as may be indicated. As a rule the ward medical officer can anticipate the patient's needs for a period of 2 to 4 weeks at the time he is assigned to work.

It is obvious that the person in the occupational therapy department who assigns the patient to his job must be very familiar with the

patient's order sheet, with his response to his work, and with the nature of the work in the jobs to be assigned. Only by the process of analyzing all the jobs to which the patients may be assigned and charting them can this properly be accomplished.

RECORDS AND FORMS

Forms 1, 2, and 3 apply to the patient.

FORM 1.—ORDER SHEET FOR OCCUPATIONAL THERAPY

Date: _____
 Name: _____ Rate: _____ Ward: _____
 Diagnosis: _____
 Special talent and qualifications: _____
 Purpose of occupational therapy: _____
 Part to be given work, e. g.: Knee, ankle, elbow, back and general.
 Type of work desired for patient, e. g.: Lifting, walking, squatting, gripping, hammering, etc.
 Schedule: _____

Amount of work	First week	Second week	Third week	Fourth week
A. Total hours per day.....				
B. Time of each period.....				
C. Rest period.....				
D. Type of rest, e. g.: Sitting, lying, standing.....				

What patient must not do: _____
 Remarks: _____

Signed: _____
 (Officer) Ward Medical

All parts of the Order Sheet are self-explanatory except "Schedule." Work schedules classified as A, B, C, etc., are submitted by the department to the medical officers for their guidance in ordering therapy. Schedule A refers to the lightest work. This is never equal to more than one-fourth of the patient's average duty. Schedule B is a light work schedule equal to about one-half the patient's average duty. Schedule C is a heavy work schedule equal to the particular patient's usual and regular duties.

A patient who has no disability to be treated specifically may be given schedule A for one or two weeks, schedule B for one or two weeks and schedule C at the end of this period.

Special schedules for the treatment of specific disabilities are also furnished. For example a patient with a postoperative semilunar cartilage of the knee would be given a schedule beginning with minimum periods of weight-bearing and progressing to many daily periods of weight-bearing, such as stair climbing and special exercises. Neuropsychiatric patients may have a special form of occupation given them for the purpose of creating interest and skill in a particular type of work.

FORM 2.—RECORD AND REPORT OF OCCUPATIONAL THERAPY DEPARTMENT

Date									
Time retained									
Work period									
Rest period									
Type of work									

Remarks:

Results:

On the reverse of the Order Sheet is the Record and Report Sheet. On this sheet is kept an up-to-date record of the type of work the patient is doing and of his responses. At the time of the patient's discharge this report is returned to his medical officer who abstracts it for the patient's health record. A weekly report of the patient's progress may also be made by the department to the medical officer.

FORM 3.—OCCUPATIONAL THERAPY WORK-CARD

Name: _____ Rate: _____ Ward: _____ Section: _____

Detail _____

Type of work assigned _____

Amount of work by week	First	Second	Third	Fourth
Total hours per day _____				
Work period _____				
Rest period _____				
Type of rest _____				
Must not do _____				

ATHLETIC PROGRAM

Type of exercise _____			
Play period _____			
Rest period _____			
Total hours per week _____			
Remarks _____			
Recommendations _____			

The work-card is taken by the patient to the person in charge of the job to which he is assigned. On the back of the work-card this person records any comment required on the patient, such as complaint that he could not do the work, refusal to cooperate, leaving his work without permission, and the like. The medical officer may inspect the patient's work-card at sick call. By use of the simple work

analysis chart shown here patients can be properly assigned to their details.

EXERCISES AND ATHLETICS

It is not always possible to give the patients the exact types of exercises needed in the various jobs found around a Naval hospital. Therefore it becomes necessary to supplement their work programs with special gymnastic exercises or sports.

Groups of patients, for example, may be assigned to such exercises as lifting sandbags for back muscle development, or lifting sandbags strapped to the lower extremities for abdominal or leg muscle development. The patient may be retained several hours during the day for such supervised exercises which are alternated with the proper rest periods.

This form of gymnastic exercises becomes rather boring to the patient and should be substituted by work, games, or athletic activities that will carry out the same muscular action when possible. However it has the advantage of absolute dosage that can be graduated, and in cases of "goldbricking" the boredom might serve a useful purpose.

These gymnastic exercises are given by the physiotherapy department by means of simple sandbags weighing from 10 to 100 pounds for lifting, and 1- to 8-pound bags with straps that can be secured to the hands or feet.

It should be remembered in assigning exercise, work, or athletic periods that a number of short periods throughout the day are better than fewer long periods in which the point of fatigue may be reached.

When patients can be interested in a competitive game incorporating suitable exercise in the right amount, they can be induced to take such exercise without complaint. Even patients with fully developed neuroses often become thoroughly engrossed in the competition of a game. Such games as horseshoe pitching, bowling, checkers on a board 16 feet square with checkers weighing 10, 20, 30, or 50 pounds, volleyball, and medicine ball have been used successfully. Swimming is ideal.

All sports or games are an adjunct to the patient's work assignment, so that the total day's output of muscular activity will be as the medical officer prescribed it. This requires the matching of a semi-invalid patient against another semi-invalid patient, rather than against a well individual, otherwise the patient would become discouraged.

CHART 1.—*Industrial occupational therapy work analysis chart*

[o= None. x= Small amount. xx= Moderate amount. xxx= Large amount.]

Detail	Work	Work- ing on even surface	Work- ing on uneven surface	Walk- ing	Stand- ing	Stoop- ing, short periods	Stoop- ing, long periods	Lifting less than 25 pounds	Lifting 25 to 50 pounds	Squat- ting, short periods	Squat- ting, long periods	Sitting	Stair climb- ing	Shoul- der ex- ercise, from below	Shoul- der ex- ercise, over- head	Elbow work as in pump- ing	Fine finger work
Boiler room	Painting				x	x					xx		xxx	xxx	xx	x	
Do	Sweeping	x															
Do	Wash paint work	x															
Laundry	Folding clothes				xxx							xxx					
Do	Washing clothes				xx												
Do	Pressing				xx												
Farm	Hoeing		xxx														
Do	Irrigating	xx															
Do	Pulling weeds					xx	xxx										
Do	Transplanting																
Do	Clearing ground								xxx								
Carpenter shop	General work				xxx			xx									
Electrical shop	do				xx												
Plumbing shop	do				xx			xx									
Radio room	do				xx							xx					
Office	Clerical											xx					
Messenger	Errands			xx								xx					
Central supply	Folding gauze											xxx					
Plaster room	Making bandages				xx							xxx					
Ward cleaning	Sweeping	xx															
Do	Dock waxing			xx		xx								xx			
Do	Wash paint work					xx											
Bowling alley	Pin setting					xx											
Lawn and grounds	Heavy sweeping, mowing lawn, general heavy work.	xxx	xx											xx		xx	
Athletics							v	x	xx	xx	x						

This program may be expanded ad lib.

ARTS AND CRAFTS

Occupational therapy has been developed around creative arts and crafts. It is quite satisfactory for a patient to be carried through his entire illness on an arts and crafts program, provided such a program is graduated and extended until it includes an amount of sustained activity equal to that of the patient's regular duty. To do this requires special equipment and personnel that are usually not available in sufficient quantities in general Naval hospitals to serve all the patients in need of a conditioning program.

It has, therefore, been our policy to use a small staff of volunteer occupational therapists in the arts and crafts program for patients who are not ambulatory. Special interests in Naval hospitals are weaving, knotting, wood carving, drawing, clay modeling, leather work, airplane model making, block printing, and the designing of simple jewelry made from shells, nuts, and the like. This is of special value for patients who are bedfast for any extended period. It makes for better spirit, morale, and discipline on the ward, and renders the patient more amenable to the rehabilitation activities that he will later require. As soon as the patient becomes definitely ambulatory, he is transferred from arts and crafts to industrial therapy and athletics.

COMMENT

It is obvious that any program in a Naval hospital involving so many different departments of the hospital must be under the direction of the commanding and executive officers. It is only by their support and active interest that such a program can be effective. This in turn brings about the interest and cooperation of the persons in charge of the carpenter shop, garage, laundry, and other departments of the hospital using such labor.

Under this occupational therapy program, the hours of patient labor increased tenfold over those for an 18-month period under the haphazard program of the "outside detail." Needless to say it is not one of the purposes of the program to obtain patient labor. Therapy valuable to the recovery of the patient is foremost. This does not, however, mean that occupational therapy should not cooperate with the different departments of the hospital to furnish the kind of labor needed. A survey of the departments of this hospital using such patient labor revealed that they are highly satisfied with this system. The reason for the large increase of patient labor is that patients are properly classified in the jobs they can do; ward medical officers will send partially disabled patients when they know they will be given exactly the amount and type of work prescribed.

Under this system the occupational therapy is actually administered in the various departments of the hospital where the patient is assigned to work. Therefore the attitude of the people in charge of the jobs where the patients work has much to do with the success or failure of the therapy. Almost any good, well adjusted craftsman or artisan who loves his work can become a good industrial occupational therapist with a little instruction. First their responsibility as part of the hospital staff who are treating patients should be explained to them. Second, they should be encouraged to exhibit pride in their own skill but not be too critical of beginners or those who have little skill.

Each patient assigned to occupational therapy should have an explanation from his medical officer or from someone in the department as to the reason he is beginning to work and the benefits expected. His work-card should be thoroughly explained to him.

Patients on occupational therapy details are usually given liberty on the same basis as are the personnel of the hospital except for certain types of patients whose conditions contraindicate their being granted liberty. Usually if a patient is unfit to be assigned to some type of occupational therapy he is not physically fit to have liberty.

SUMMARY AND CONCLUSIONS

1. An occupational therapy program designed gradually to condition the patient to the physical requirements of his duty is essential in a Naval hospital. When a patient has been conditioned to work before being discharged from the hospital it has been found that rehospitalization for the same condition is much less frequent.

2. The man-hours of patient work and productivity are increased greatly with a properly administered occupational therapy department.

3. "Goldbrickers" can often best be treated by proper administration of occupational therapy.

4. The morale and discipline of the patients in a Naval hospital where a full program of occupational therapy is in use is greatly improved.

CLINICAL NOTES

**BLASTOMYCOSIS OF THE SKIN (GILCHRIST TYPE)
WITH ASSOCIATED BLASTOMYCETIC
PULMONARY DISEASE****REPORT OF A CASE****ARTHUR SAYER**

Lieutenant Commander (MC) U. S. N. R.

Cutaneous blastomycosis (blastomycetic dermatitis, saccharomycosis hominis) is a chronic inflammatory disease of the skin which generally appears first as a small papule and gradually spreads peripherally to form a sharply elevated, verrucose patch of varying size. The older lesions present a characteristic sloping border in which minute, deeply seated abscesses are present, and the blastomycetes are readily found in the seropurulent contents of the abscesses (1).

The blastomycoses are chronic, infectious diseases produced by budding fungi which commonly attack the skin and give rise to reddish, moist papillomatous lesions. These budding fungi frequently also infect one or more of the internal organs. The term blastomycosis has come to denote a more or less definite clinical syndrome, produced by multiple causative agents (2).

Cutaneous blastomycosis has been found to be produced by different variations of fungi in different parts of the world. In the United States it is caused by Gilchrist's organism, *Blastomyces dermatitidis*, now commonly called *Zymonema dermatitidis*. In Europe it is considered to be caused by Busse's organism, now known as *Cryptococcus hominis*. In South America there are several varieties of fungi of the *zymonema* and *paracoccidioidal* groups, which are considered as the cause of a blastomycotic type of infection. For an excellent description of the various types of the blastomyces organisms, as well as their morphologic differentiations, the reader is referred to the excellent studies made by Moore (3).

All maladies produced by fungi which manifest budding or blastosporulation were placed with the blastomycoses by Brumpt (4). He recognized those caused by saccharomycetes, mycotorulae and torulae, and removes from the blastomycoses the lesions produced by non-budding fungi.

In spite of the multiplicity of the causative agents, the blastomycetic skin lesions present a uniform clinical appearance. The picture most often encountered is that of an onset with miliary abscesses later developing into verrucose plaque and ulcerations, and finally showing scar formations. A precise diagnosis can be made only by differential diagnosis, eliminating diseases such as syphilis, tuberculosis, yaws, leishmaniasis cutis, suppurative tineas, neoplasms, and eruptions due to bromides and iodides. All of these may resemble blastomycosis in some aspects. A definite diagnosis is made only by microscopic findings of the blastomycetes in the lesion or on culture in suitable media.

Blastomycosis is not very common in human beings, and it was not recognized as a disease caused by a specific organism until 1894. At that time Busse (5) reported the first case of blastomycosis which was due to a yeast organism, in a fatal case of pyemia with cutaneous manifestations. Gilchrist (6) proved the first American case of blastomycosis when he demonstrated microscopic sections which contained budding organisms from a lesion previously clinically diagnosed as tuberculosis cutis. Since then a fairly large number of observers have reported cases of blastomycosis cutis (7) (8). There are 360 known cases of blastomycosis reported in the literature to 1939. These blastomycotic cases were thoroughly reviewed in the articles by Martin and Smith (9) (10).

Blastomycotic skin lesions occur with greatest frequency on the face, wrists, and forearms, but no portion of the body is exempt. The eyelids are a frequent site of the disease, with ectropion usually a frequent development. As a rule pain is slight or absent except in areas which are acutely inflamed as a result of secondary infection.

The cases having systemic manifestations are the more serious. When the disease becomes disseminated, the dominant symptoms depend upon the organs and tissues infected. The lungs, liver, kidneys, spleen, skin, and cutaneous tissues bear the main burden of the infection in some cases, while in other instances, the bones (elbows, tibia, vertebrae), and joints exhibit the chief symptoms. In systemic cases the first symptoms are fever and loss of appetite, followed by emaciation, and often by extreme general weakness. If albumin and casts are found, they indicate a nephritis; but involvement of the kidneys has been found in the postmortem examination in cases presenting no renal symptoms during life. The mortality in the reported systemic blastomycosis cases is about 90 percent.

Case report.—A private in World War I was "gassed" and treated for this condition from 28 July 1918 to 19 October 1918 and again from 10 November to 15 November 1918. His physical condition at discharge from the Army was marked "good" on his certificate.

After discharge to civilian life, he presented himself at various times for medical treatment at Veterans' hospitals. On 13 July 1922 he was admitted to a Veterans' hospital complaining of weakness in his lower extremities. A tentative diagnosis of pseudomuscular atrophy was made at that time. He was next admitted to the same hospital on 4 June 1924 on account of a persistent cough and a diagnosis of pulmonary tuberculosis (chronic, incipient, at both apices) was made. On his next admission the diagnosis of chronic pulmonary tuberculosis was confirmed. It was noted that the lungs showed improvement from their previous condition, and that there were no signs of activity in the lungs. The muscular weakness of the lower extremities was more pronounced, and the diagnosis of progressive muscular dystrophy of the lower extremities was established.

The patient did not seek further treatment until 25 January 1939 when he was again hospitalized for chronic arrested pulmonary tuberculosis and advanced progressive muscular atrophy of the extremities. At that time it was recorded that he had an eruption on his face which was diagnosed as blastomycosis cutis. On his next hospital admission in January 1941 he was treated for progressive muscular dystrophy of his extremities and blastomycosis cutis on his face and neck.

The patient first came under my personal observation when he was admitted to a Naval hospital on 22 June 1943. He complained of marked weakness of his lower extremities, and discomfort in the skin of his face and neck. He stated that he had been practically unable to walk since December 1942. He did not complain of pains, but only that he did not have the strength to stand up for more than a few minutes. He stated that the eruption on his face and neck began in 1936, after he was bitten on his neck by a spider. The patient said that a small, red lesion developed behind the right ear at the site of this spider bite, and that this lesion had gradually spread, and extended to the right side of his neck and face.

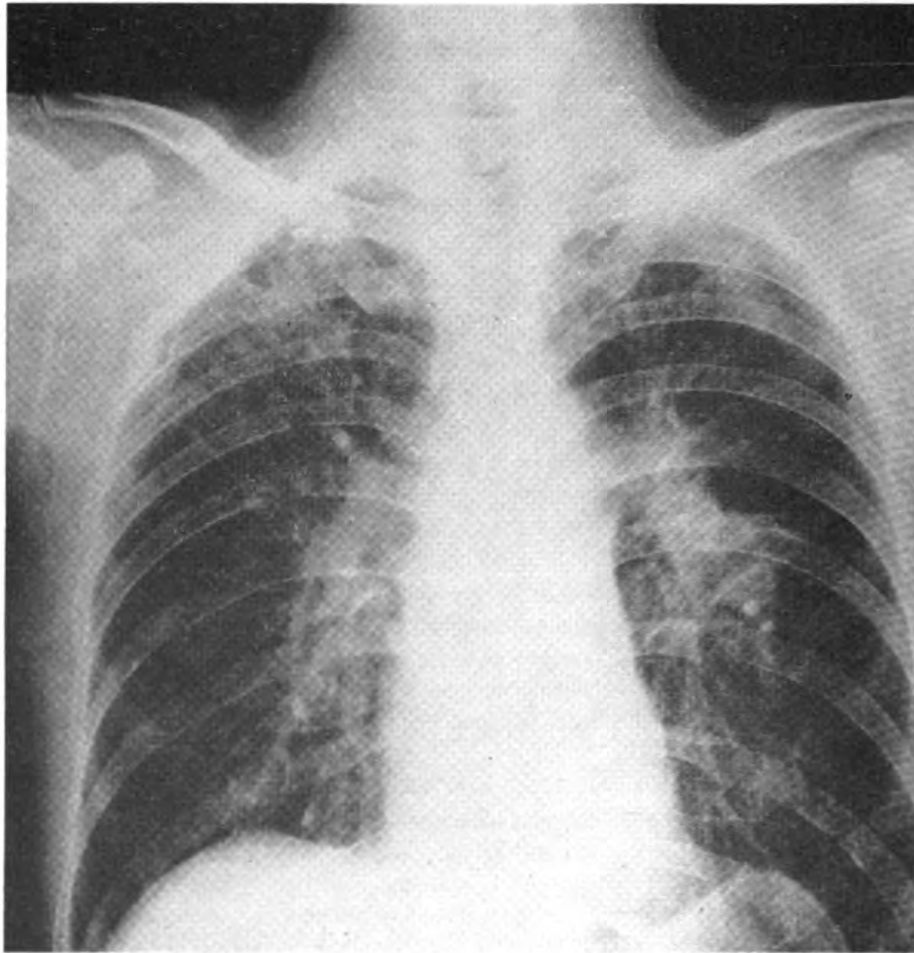
He was given potassium iodide by mouth and x-ray treatments to the face and neck lesions when he was a patient at the Veterans' hospital in 1939. He said that the skin lesions responded satisfactorily to this treatment and he continued taking 120 grains of potassium iodide daily for 3 years steadily after he left the hospital, but the skin lesions became gradually larger and more extensive despite this medicine.

The physical examination on admission revealed a well-developed, white male, aged 48 years, who was unable to walk because of a marked atrophy and weakness of the muscles of his lower extremities and whose patella reflexes were sluggish and obtained only on reinforcement. Other findings were irrelevant except slight dullness throughout the lungs; the breath sounds were harsh over both upper lobes and there were a few scattered fine râles heard after coughing.

Examination of skin.—There was an extensive eruption, involving mainly the right side of the face and neck, and a small similar eruption on the posterior aspect of the left elbow. The lesions were moderately elevated, dark red in color, and the borders were sharply defined and sloping. Some areas showed tumefaction, and on pressure over the tumefied portion, pin-point pustules were readily demonstrated. The lesions on the neck were band-like and presented a scalloped border, and the general appearance of the eruption was geographic. In the occipital region of the scalp, it ran off as a gyrate, band-like pattern and had definite sloping borders. There was marked ectropion, with total absence of the eyelashes. Practically the entire right auricle was absent due to its gradual destruction a few years ago. Within the borders of the eruption, on the right cheek and right side of the neck, there was white scarring, with atrophy of the skin and areas of brownish pigmentation and telangiectases. The skin lesion

on the left elbow was 10 by 12.5 cm. and consisted of a red, elevated, band-like serpiginous border, with a supple white-scarred center. This elbow lesion had the appearance and characteristics of the eruptions on the face and neck.

Laboratory examinations.—Extensive blood and urine examinations were performed which yielded little relative information. Iodine content determinations of the blood disclosed 0.231 mg. iodine per 100 cc. serum and the blood clot contained 0.0992 mg. iodine per 100 gm. in a morning specimen. An afternoon specimen was reported to contain 0.306 mg. iodine per 100 cc. serum, and 0.099 mg. per 100 gm. of blood clot. The normal iodine content of whole blood is 0.008 to 0.015 mg. per 100 cc. and the iodine level of the patient's blood is therefore



1. Diffuse mottling and areas of denser parenchymatous infiltration, on early examination.

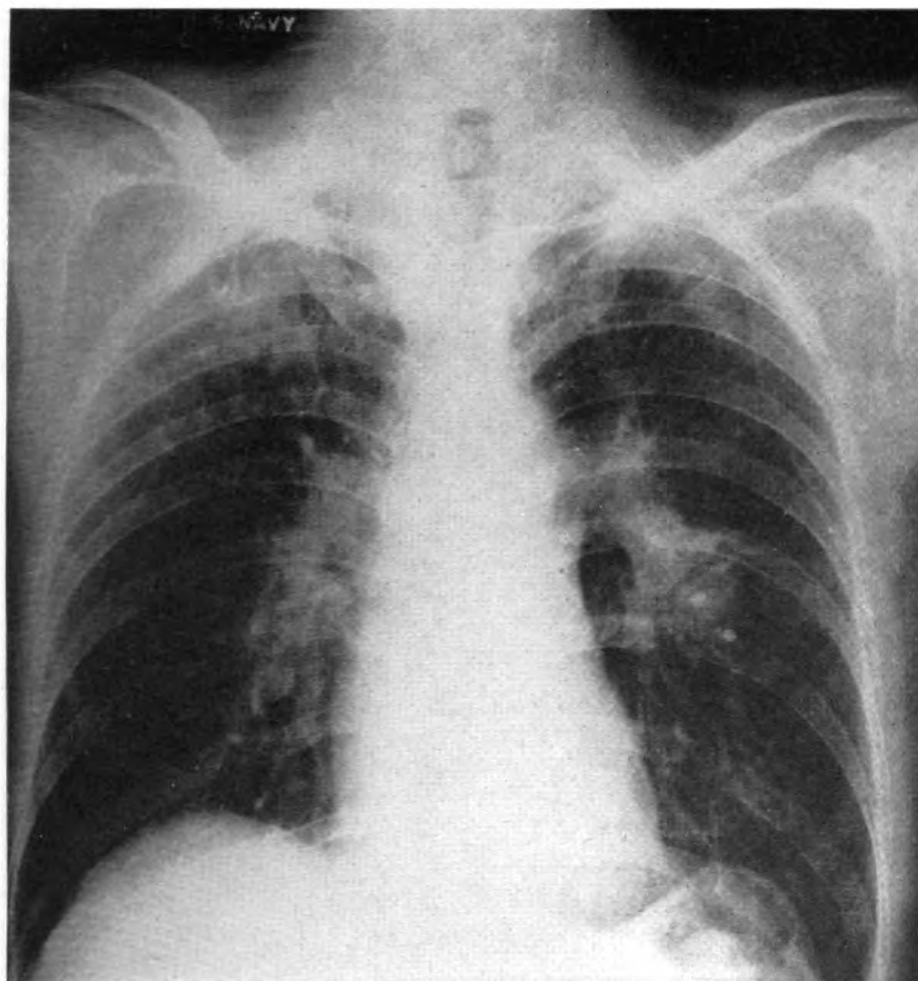
approximately 20 times the normal amount. Repeated sputum examinations failed to show the presence of acid-fast bacilli.

Biopsy report.—A section of the skin lesion on the right side of the neck was removed for biopsy. The microscopic examination disclosed hyperplasia and multiple abscesses in the epidermis and upper portion of the cutis. There was an extensive round cell infiltration, with occasional plasma cells and numerous giant cells (foreign body type) in the upper cutis. The blastomycetic cells were readily seen throughout the tissue.

X-ray examination.—X-ray examination of the lungs showed the diaphragm on the left side pulled upward by adhesions in the center. Both costophrenic angles were clear. There was a fine, diffuse, cottony mottling, with some areas

of dense parenchymatous infiltration extending from the apex to the diaphragm in all the lobes of the right lung. The upper lobe showed an increase in this diffuse density. There were many fine linear shadows radiating upward from the hilus into the upper and middle lobes. In the region of the third rib, posteriorly, there was an area of dense calcification approximately 1 cm. in diameter. There were a few scattered areas of decreased density at the periphery of the upper lobe, simulating emphysematous blebs or small areas of cavitation. The lobes of the left lung showed similar findings but to a lesser extent (fig. 1).

Reexamination made on 21 September 1943, after 3 months of continued treat-



2. Improvement after 3-month treatment with large doses of iodides.

ment with large doses of potassium iodide showed a definite disappearance of the cottony infiltration in the lower two-thirds of the lungs, as well as a decrease in the parenchymatous infiltration in both upper lobes (fig. 2).

Clinical progress.—Since this patient had been taking about 180 grains of potassium iodide daily for the past 3 years, it was felt that he would require a much larger dosage to influence the blastomycosis lesions. He showed no evidence of any iodism, so it was apparent that he was not absorbing very much of the potassium iodide that he had been taking. In spite of the long use of this medication the administration of 180 grains of potassium iodide daily by mouth was continued and supplemented by 31.5 grains of sodium iodide dissolved in 10 cc. of water intravenously. The skin lesions began noticeably to improve after about 2 weeks of this treatment. The lesions gradually became less

edematous, and flattened moderately in the most tumid portions, and the patient stated that he was able to move his neck more freely and with less discomfort.

On 15 August 1943 the dosage of potassium iodide by mouth was increased to 300 grains daily, and he continued receiving sodium iodide 31.5 grains intravenously daily. He was carefully observed for iodism effects. He stated



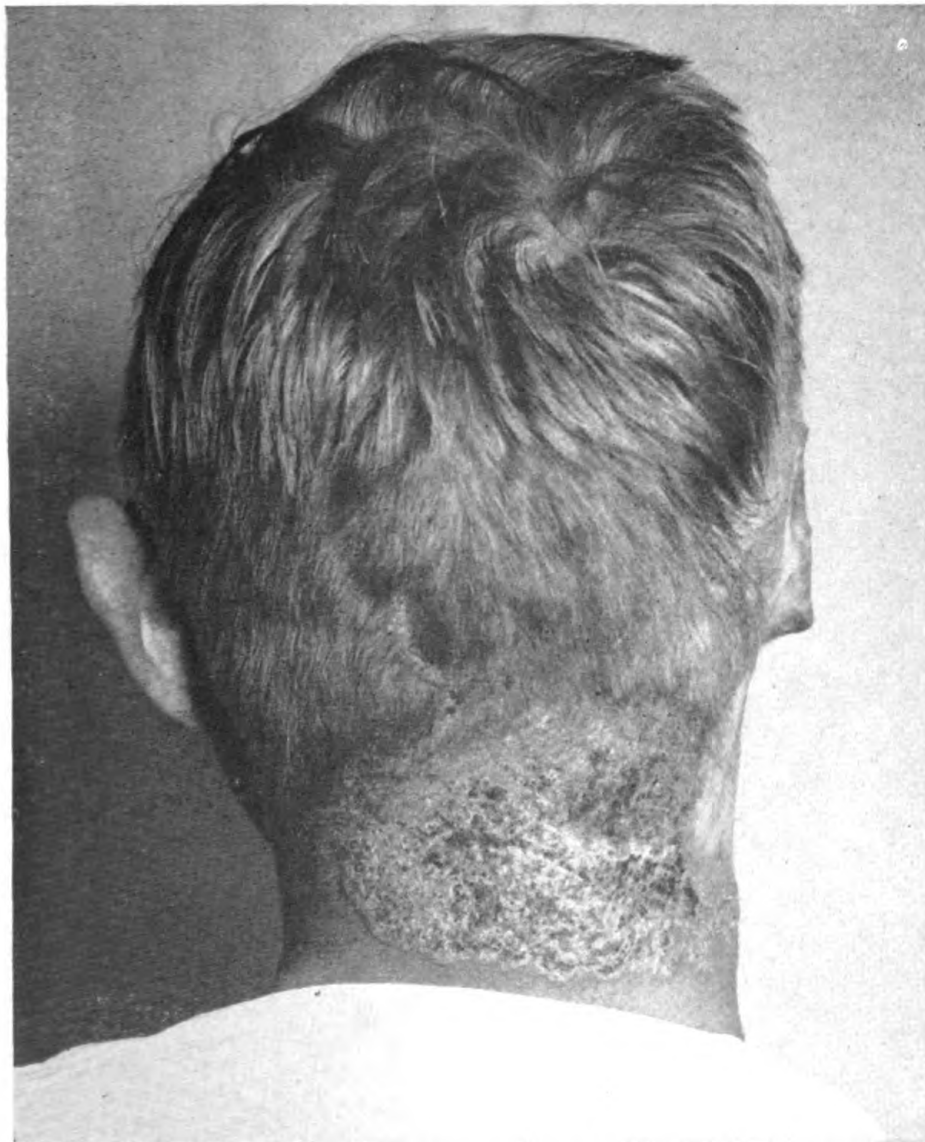
3. Showing the elevated sloping border on the neck, and the whitish scarring on the right cheek; brownish pigmentation and telangiectases in the scarred region; and almost total destruction of the right ear.

that he now had a brassy taste in his mouth continuously, but he felt otherwise comfortable and there were no signs of any iododerma on his body. The dosage of potassium iodide was accordingly further increased to 360 grains daily by mouth on 10 September and again increased to 420 grains daily, and in addition he also received the daily intravenous injections of sodium iodide.

The blastomycosis cutis lesions continued to regress further under the increased potassium iodide treatment. The lesions were paler in color and there

was definite flattening of the papillomatous elements and of the borders. There were several areas of almost normal pinkish smooth skin appearing on the right cheek and forehead. The photographs were taken on 20 September and they show the blastomycosis cutis lesions considerably improved since his hospital admission, and now with areas of healing as shown in figures 3, 4, 5.

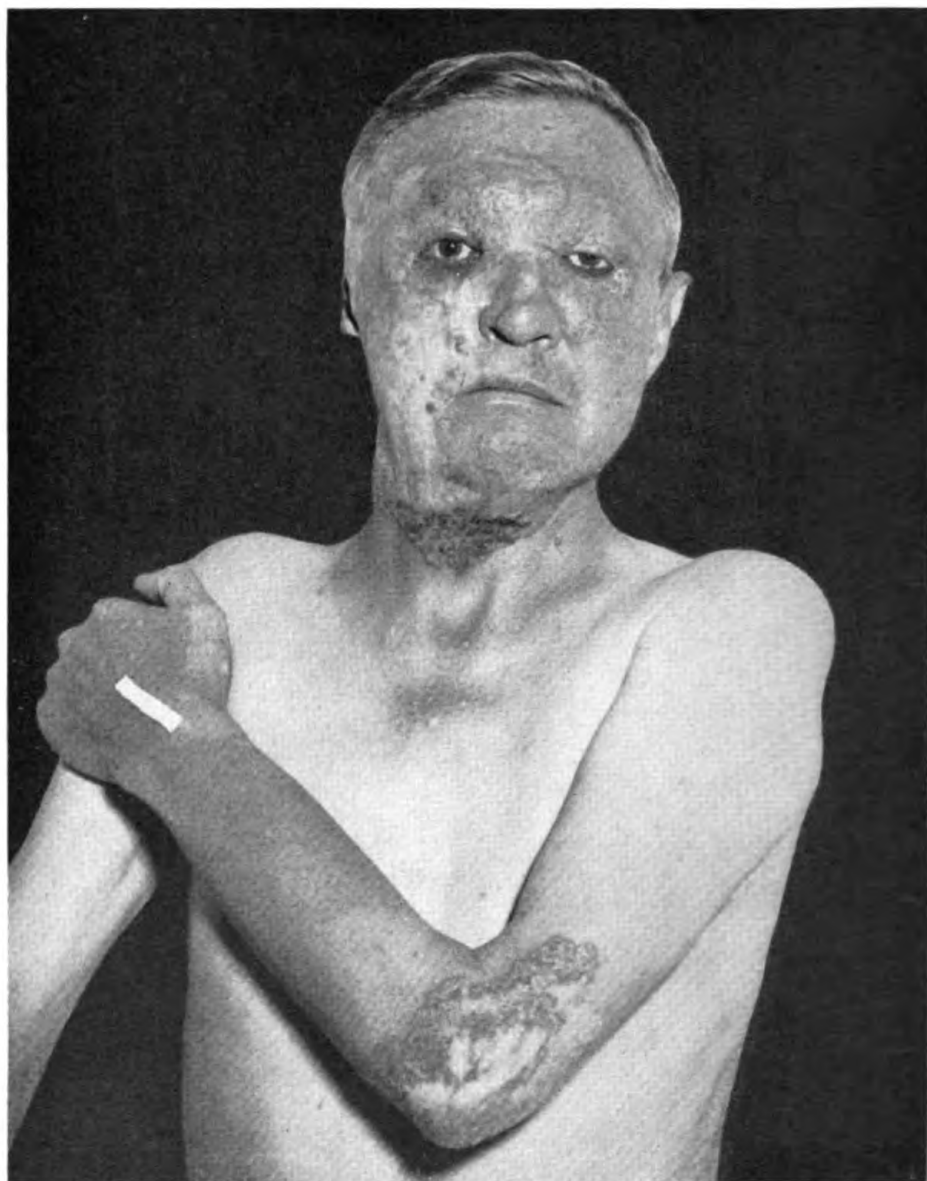
It was also noted that the lungs showed definite clearing of the parenchymatous infiltration under the increased potassium iodide therapy. This was clearly



4. Elevated sloping border and the fungating papillomatous lesion in the center.

shown by the x-ray films taken on 21 September 1943. On 24 October 1943 the potassium iodide dosage was increased to 480 grains daily, and the intravenous sodium iodide therapy was discontinued. This was done primarily to determine whether the oral potassium iodide medications would be effective without the intravenous iodide. The patient continued to improve, and the cutaneous blastomycosis continued to recede and flatten under oral potassium iodide medication. However, the improvement was at a much slower rate, and after 6 weeks of treatment with these large daily doses of potassium iodide, the skin lesions seemed to remain more or less stationary.

It was suggested that possibly the sulfa drugs might influence the further regression of the blastomycosis lesions and accordingly the patient was given 6 gm. of sulfadiazine by mouth, daily for 8 days (14 to 21 December). The blood sulfadiazine level was reported as 11.15 mg. per 100 cc. on 17 December, and a blood count and blood smear on 19 December were reported as normal. The blastomycotic skin lesions did not respond favorably to the sulfadiazine therapy,



5. The smaller lesion on the extensor aspect of the left elbow. The adhesive seen on the dorsum of the hand was placed at the site of a venipuncture made by the recent injection of sodium iodide solution.

and became more elevated and more crusted. Numerous pinpoint abscesses were seen along the borders of the lesions. The skin lesions were now definitely worse than they had been under the potassium iodide treatment.

Penicillin therapy was then suggested as worth trying and accordingly 100,000 Oxford units of penicillin were given daily in divided doses both intramuscularly and intravenously for 20 consecutive days. The patient received a total of 2,000,000 Oxford units of penicillin, but there was no noticeable improvement

observed in the blastomycetic lesions. The skin lesions remained elevated and crusted and with millary abscesses throughout the period of the penicillin treatment.

Inasmuch as the potassium iodide treatment proved to be the most effective of all the medications used, this therapy was reapplied and the patient started on small doses of potassium iodide by mouth. This was rapidly increased until he was again receiving 480 grains daily. The blastomycetic skin lesions began to improve within a few days after the potassium iodide treatment was resumed, and at the end of 2 weeks the lesions had flattened considerably and were much less crusted, and there were no millary abscesses visible. The patient is to continue receiving 480 grains of potassium iodide daily as long as he shows no signs of iodine intolerance. It is thought that a prolonged course of treatment with iodides will be well tolerated.

COMMENT

Blastomycosis cutis is not a common skin disease, and each new case should be recorded in the literature. This patient presented a classical picture of the disease with all the characteristic cutaneous lesions and showed the papillomatous elements, the raised sloping border, the small pustules, and the healed white scarring of the old lesions.

It is apparent that iodine therapy is the treatment of choice and that the blastomycosis lesions are favorably influenced solely by the high content of the iodine in the circulating blood (in this patient approximately 20 times the normal amount).

X-ray therapy is considered very helpful in these cases. X-ray treatments to the skin lesions were given to this patient in 1939 but it was impossible to obtain the record of the x-ray dosage and the number of treatments that he received at that time. The patient now has a roentgen ray dermatitis from his previous treatment and additional x-ray therapy is not deemed safe at this time.

It is believed that the lung findings in this patient indicate a blastomycetic infection. The inability to find acid-fast bacilli in his sputum in the past makes the former diagnosis of pulmonary tuberculosis unlikely.

SUMMARY

1. A case of blastomycosis cutis with associated blastomycetic infection of the lungs is reported.

2. The patient had been taking 180 grains of potassium iodide by mouth daily for about 3 years prior to coming under present observation. The dosage of potassium iodide was insufficient to arrest the progress of his blastomycetic infection.

3. The dose of potassium iodide was gradually increased to 480 grains by mouth daily, and he also received 31.5 grains of sodium iodide intravenously every day for 4 months. This treatment has resulted in improvement of his symptoms and marked regression of his cutaneous and pulmonary lesions.

4. He has shown no evidences of iodism or intolerance to the large doses of iodides which he has been receiving.

5. He received a course of sulfadiazine treatment with no apparent benefit.

6. He received two million Oxford units of penicillin with no apparent benefit.

7. The patient is now under treatment with large doses of potassium iodide by mouth.

REFERENCES

1. ORMSBY, O. S.: *A Practical Treatise on Diseases of the Skin for the Use of Students and Practitioners*. Lea & Febiger, Philadelphia, 1934. 4th edition. pp. 1026-1037.
2. SUTTON, R. L., and SUTTON, R. L., Jr.: *Diseases of the Skin*. C. V. Mosby Co., St. Louis, Mo., 1939. 10th edition. pp. 1132-1151.
3. MOORE, M.: Blastomycosis, coccidioidal granuloma and paracoccidioidal granuloma; comparative study of North American, South American, and European organisms and clinical types. *Arch. Dermat. & Syph.* 38: 163-190, August 1938.
4. BRUMPT, E.: *Précis de Parasitologie*. Masson et Cie., Paris, 1936. 5th edition. p. 1647.
5. BUSSE, O.: Über parasitäre Zelleinschlüsse u. ihre Züchtung. *Zentralbl. f. Bakt.* 16: 175, 1894.
6. GILCHRIST, T. C.: Case of blastomycetic dermatitis in man. *Johns Hopkins Hosp. Rep.* 1: 269, 1896.
7. SHELDON, J. G.: Case of blastomycetic dermatitis. *J. A. M. A.* 38: 1356-1357, May 24, 1902.
8. RICKETTS, H. T.: Oidiomycosis (blastomycosis) of skin and its fungi. *J. M. Research* 1: 373-546, 1901.
9. MARTIN, D. S., and SMITH, D. T.: Blastomycosis (American blastomycosis, Gilchrist's disease); review of literature. *Am. Rev. Tuberc.* 39: 275-304, March 1939.
10. Ibid.: Blastomycosis (American blastomycosis, Gilchrist's disease); report of 13 new cases. *Am. Rev. Tuberc.* 39: 488-515, April 1939.



ROENTGEN STUDY OF VIRUS PNEUMONIA

Virus pneumonia produces fairly characteristic pulmonary changes as shown by roentgenologic examination. These consist of tracheobronchitis, peribronchitis, focal atelectasis, edema, and emphysema. The presence of emphysema militates against total lobar atelectasis, so that uniform consolidation is infrequently observed.

Roentgenograms show clearing of the lungs on the seventeenth day and a return to normal on the twenty-fifth day.

Resolution progresses centripetally, the peripheral portions of the lungs being the first to clear.

Roentgenologic evidence of interstitial pneumonitis and partial atelectasis may remain long after clinical cure.—LEVENE, G., and STERMAN, I. A.: Roentgen study of primary atypical virus pneumonia. *Radiology* 42: 446-457, May 1944.

CLOSURE OF PERSISTENT BRONCHOCUTANEOUS FISTULA BY PEDICLE MUSCLE GRAFT

A CASE REPORT

CLIFFORD D. BENSON
Commander (MC) U. S. N. R.

Abrashanoff in 1900 sutured a pedicle muscle flap over bronchial stomas and in 1911 reported the direct implantation of muscle into the fistulous opening (1). The papers of Wangenstein (2), Pool and Garlock (3), and Nissen (4), have clearly demonstrated the usefulness of this procedure in selected cases.

Case report.—A Marine private, aged 19 years, was admitted to this Naval hospital on 16 June 1943 complaining of a draining sinus of the left chest wall. He had been injured in combat on 21 November 1942 by a .25-caliber bullet which entered the back just medial to the left scapula and emerged through the anterior chest wall at the second interspace. A massive hemopneumothorax ensued and repeated aspirations were performed in an attempt to reexpand the lung which was completely collapsed. Sulfathiazole was given by mouth. On 4 March 1943 closed drainage was performed. There was evidence of a broncho-pleural fistula. An endocutaneous flap type of drainage was done on 25 March at which time the lung was completely collapsed. The patient's general condition improved, allowing his transfer to this hospital.

Physical examination revealed no abnormalities except those of the thorax. There was limited respiratory motion of the left side with associated muscle atrophy and a draining fistula in the sixth interspace in the axillary line. Smears of the seropurulent drainage from the fistula showed pus cells and *Staphylococcus aureus* organisms. X-ray of the chest revealed almost complete reexpansion of the left lung with considerable pleural thickening in the axillary line at the fifth to the seventh rib level. There was a small defect on the vertebral border of the left scapula.

Under novocain block and endotracheal cyclopropane anesthesia, the entire fistulous tract was excised after inserting a rubber catheter as a guide. Sections of the rib above and below the fistula were resected subperiosteally as well as the rebridged bone which completely circumscribed the pulmonary opening. The latter was $\frac{3}{4}$ inch in diameter.

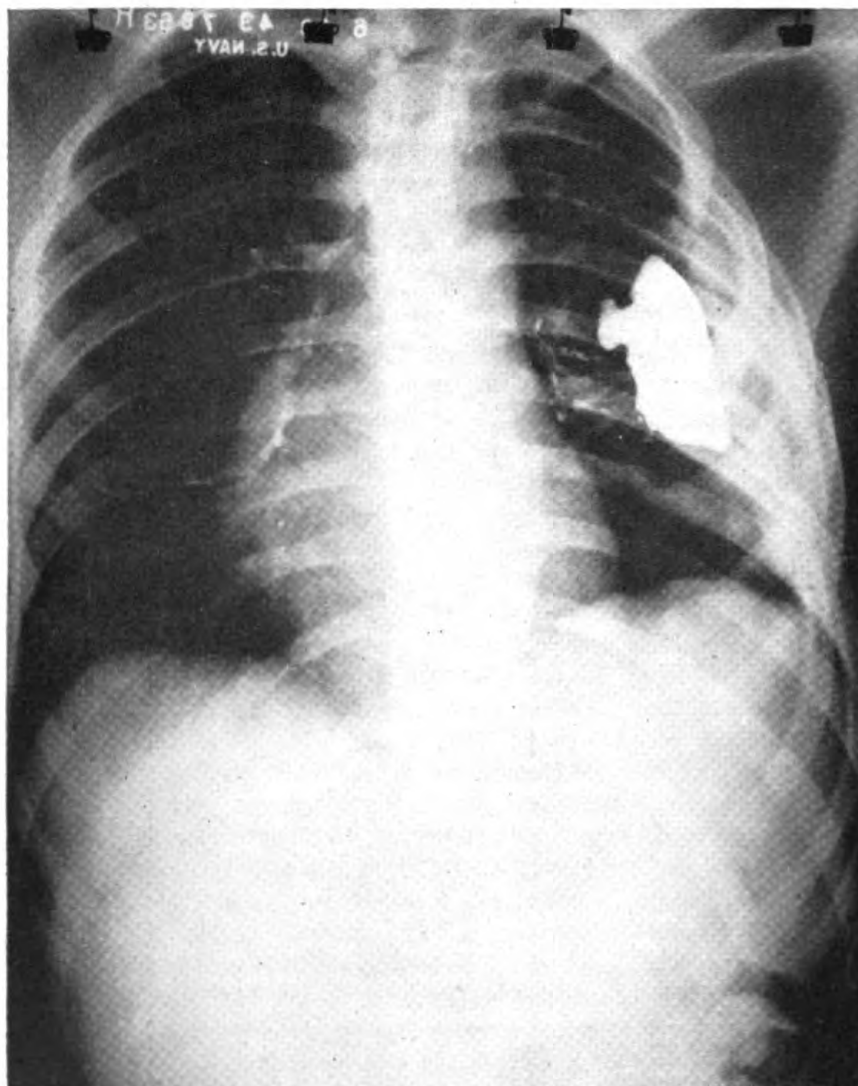
A pedicle graft was devised from the latissimus dorsi muscle, and the free end inserted into the pulmonary fistula and held in place by four intrapulmonary catgut sutures placed at 3, 6, 9, and 12 o'clock. This occluded the pulmonary opening completely with no leakage of air. The wound was closed in layers with a Penrose drain inserted down to the surface of the muscle graft to obviate subcutaneous emphysema or serum collection.

The postoperative course was uneventful except for a small area of skin necrosis in the center of the wound. The wound was completely healed on the twentieth day. This patient returned to regular duty on 4 September 1943 and has continued to remain well.

COMMENT

The persistence of a bronchial fistula after injury of the lung by a bullet of small caliber is unusual. Nearly all of the small pulmonary wounds heal spontaneously and without the development of a subsequent empyema.

In this particular patient, roentgenographic examination shortly

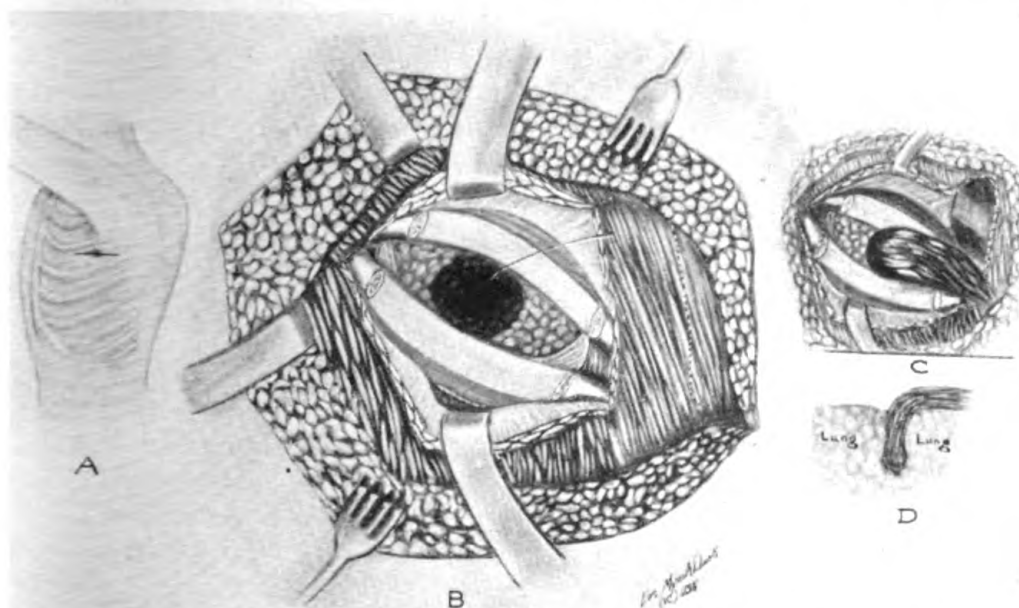


1. Lipiodol was injected into the fistula and a bronchocutaneous fistula demonstrated. The lipiodol entered the inferior posterior portion of the left upper lobe. There was no evidence of associated bronchiectasis.

after injury revealed that the bullet had struck the vertebral border of the scapula. When a bullet of high velocity strikes bone it produces an explosive effect and this impact reduces the velocity and may turn the bullet sideways. As a result the wound track is more extensive and the damage to soft tissues is correspondingly greater. This may explain the loss of lung tissue and the persistence of the bronchial fistula in this patient.

It is important to postpone the procedure of closing a bronchial fistula by a pedicle muscle graft until it is determined that there is no suppuration in the lung requiring a cutaneous fistula as a safety valve. Experience has shown that the diameter of the proximal third of the muscle pedicle should be at least one quarter of its length to assure its viability. Pool and Garlock have demonstrated experimentally that the muscle tissue remains alive a year after the implantation of a muscle graft in a bronchial fistula; the bronchial epithelium directly covers the muscle surface and the muscle is not transformed into fibrous tissue.

A period of five to six months should elapse before closing a bron-



2. Various phases of the operative procedure. **A.** Location of bronchocutaneous fistula and surgical incision. **B.** Drawing of fistula in lung. Dotted line outlines pedicle graft. **C.** Pedicle muscle graft sutured in bronchial fistula. **D.** Semidiagrammatic illustration showing complete occlusion of fistula.

chial fistula, as the majority will heal spontaneously provided that there is adequate surgical drainage of the empyema.

REFERENCES

1. ABRASHANOFF: Plastische Methode der Schliessung von Fistelgängen, welche von inneren Organen kommen. *Zentralbl. f. Chir.* 38: 186, 1911.
2. WANGENSTEEN, O. H.: Pedicled muscle flap in closure of persistent broncho-pleural fistula, with description of preservation and employment of intercostal muscle bundles by process of ribboning (for avoidance of abdominal hernia) in obliteration of large chronic empyema cavities. *J. Thoracic Surg.* 5: 27-53, October 1935.
3. POOL, E. H., and GARLOCK, J. H.: Treatment of persistent bronchial fistula; experimental and clinical study. *Ann. Surg.* 90: 213-237, August 1929.
4. NISSEN, R.: Der operative Verschluss von grossen Bronchialfisteln "Gitterlungen" und durchgebrochenen tuberkulösen Kavernen. *Deutsche Ztschr. f. Chir.* 236: 573-584, 1932.

PES CAVUS, BILATERAL

A CASE REPORT

GUSTAVE S. BRAUN

Lieutenant, junior grade H-V(S) U. S. N. R.

Pes cavus if extreme and causing symptoms is reason for rejection of an applicant for enlistment or commission.

In a recent survey 15 percent of all the orthopedic cases referred to the chiropodist were for pes cavus. The decision to survey must be made in a considerable number of these cases. It would seem, however, that with a cooperative individual every effort should be made to correct or accommodate his disability before survey is considered. The reported case demonstrates what can be accomplished.

Case report.—A seaman, second class, 24 years of age, who is a student in signalmen's school reported to the foot clinic complaining of severe pains in the metatarsal area and through the ankles, painful cramps in the legs, and an inability to stand or walk with comfort for more than one-half hour.

He had always had "sore feet" and had received sporadic treatment for his foot condition in civil life. He had learned to manipulate his feet, which slightly alleviated the spasm and afforded momentary relief. During entrance examination into the service he was able to pass the group tests for foot stability and was subsequently admitted without comment.

This subject was made acting petty officer of his recruit training company in which position he was able to complete his recruit training without serious difficulty. The patient had had his feet strapped twice during this period, but by minimizing his symptoms, attracted no particular attention to his basic condition. He was selected for signalmen's school where it was necessary for him to be on his feet for long periods. After 4 weeks the strain forced him to seek treatment.

Foot examination disclosed an extremely high arch with clawed toes. The proximal phalanges of all the toes were dorsiflexed on the foot, with the middle and distal phalanges plantar-flexed. The plantar fascia was shortened, thickened and inflamed and the general musculature of the feet and legs was in spasm. Balance was poor with the right foot overinverted and supinated, while the left was overeverted and pronated. Passive inter-foot movements were difficult but possible.

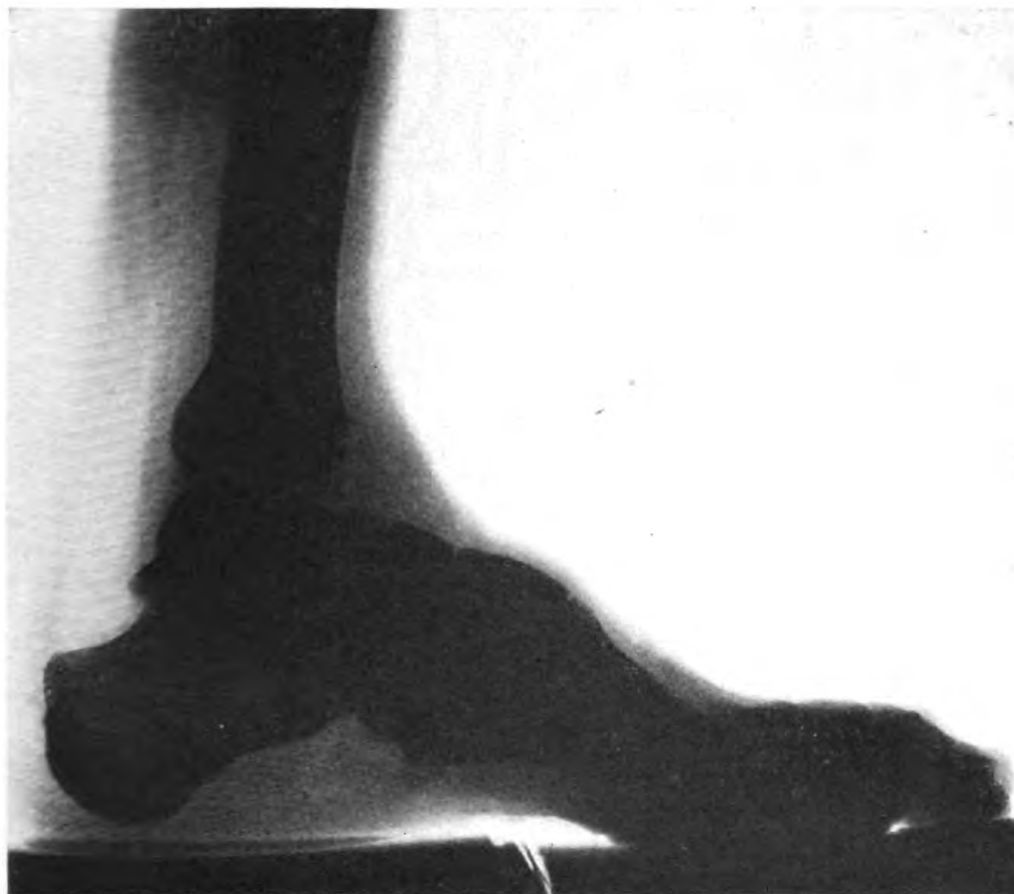
No evidence of bony pathosis was noted in the x-ray examination (fig. 1). A diagnosis of pes cavus, acquired, bilateral, of surveyable degree was made.

Treatment.—A regime of manual stretching of the contractures, restoration of articular function by manipulation, fulcral felt blockings and strapping, all supplemented with physiotherapy, was instituted with treatment every 4 days. The patient's cooperation was everything that could be desired and marked improvement was noted at the end of 3 weeks. The rate of progress suggested that, provided suitable accommodation for balance could be accomplished, prognosis

was excellent for complete correction. An appliance was constructed to provide this balance.

Construction of the appliance.—A cast was taken of the foot at rest and from it was made the positive working cast. Two pieces of ordinary sole leather were procured from the cobbler shop, and soaked overnight to make them pliable. They were then molded over the cast, strapped securely, and allowed to dry completely. This shell was then cut to approximate shoe size, and to it were added skived wedges of leather to balance the foot as desired.

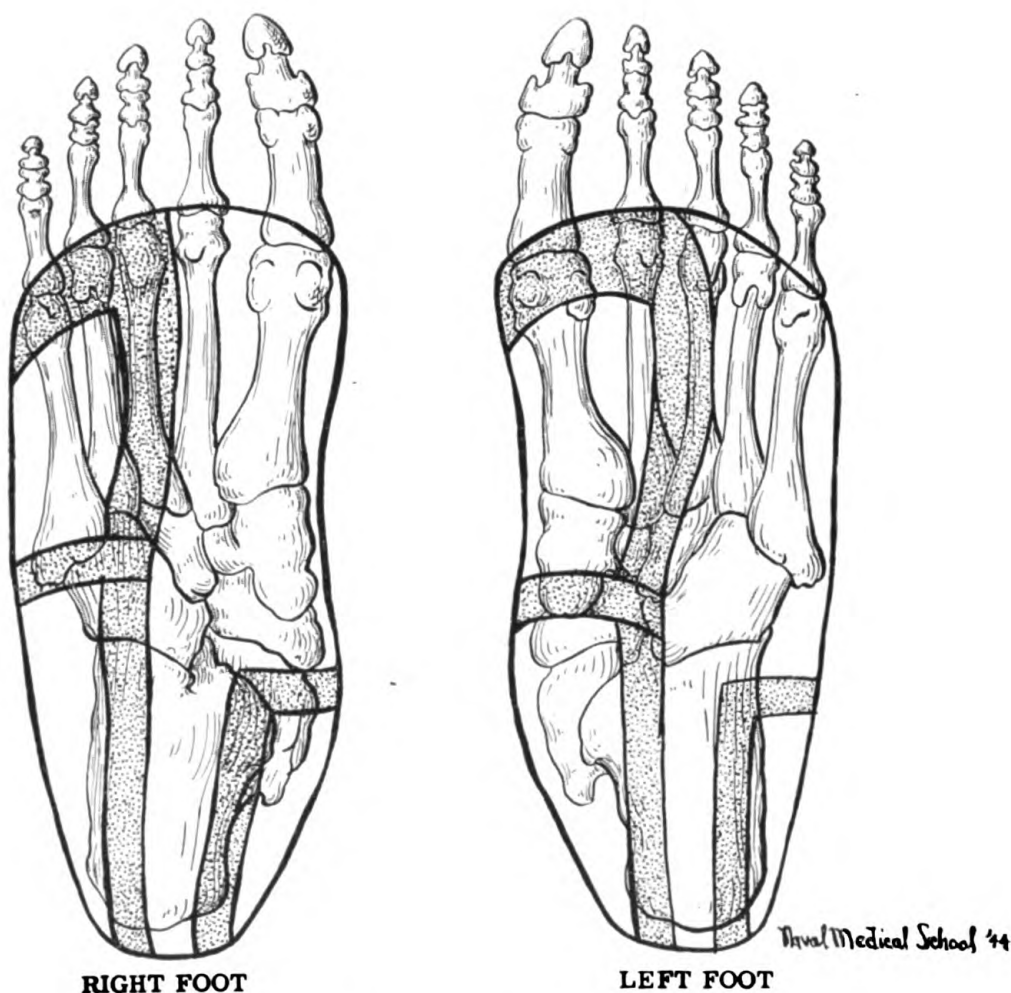
Since the right foot was over-inverted, a lateral wedge was added of sufficient



1. Lateral view showing extent of cavus.

height to bring the foot into balance and carried forward to the base of the fifth metatarsal. A medial wedge was also added to prevent pronation, thus holding the heel firmly in the desired position. This medial wedge, however, was only carried forward to the anterior edge of the os calcis. In order to carry this balance through the entire foot and to produce more natural function through the metatarsal arch another wedge was added under the posterior two-thirds of the outer three metatarsal bones.

Since the left foot was imbalanced in the opposite direction it was balanced with the long heel wedge being on the medial side, and the metatarsal one supporting the posterior two-thirds of the inner three metatarsal bones. After cementing these wedges firmly into position, the appliance was cut to exact shoe size and then taken to the cobbler shop where it was sanded down to an absolute minimum thickness and finished neatly. Figure 2 will help to clarify the position of these wedges.



PLANTAR SURFACE

2. The skived balancing wedges were placed in position as indicated. After being firmly cemented onto the original leather shell, the entire appliance was sanded down, preserving maximum thickness on the edge desired, and minimum thickness on the opposite edge.

After the fifth week of treatment the patient was given the appliance and all strappings and blockings were discontinued. The stretching and manipulation was continued at weekly intervals for the remaining time with the patient entirely comfortable at all times. Physical exertion, such as the usual physical hardening program, was possible with complete ease and comfort and the patient reported foot function never before possible. Evidence of his improved efficiency can be had from the fact that he completed his service school work with an above average grade and was selected to become an instructor.

This patient is now well on the way to complete correction and within 6 months should be able to discard the appliance. It is a case that demonstrates what success can be obtained by an intelligent approach to this condition.

ACUTE IDIOPATHIC PORPHYRIA

REPORT OF A CASE

FERDINAND FETTER

Commander (MC) U. S. N. R.

ARTHUR A. HUMPHREY

Commander (MC) U. S. N. R.

and

CHARLES R. LONGENECKER

Lieutenant Commander (MC) U. S. N. R.

Porphyria is a rare disease of metabolism in which excessive amounts of porphyrins are excreted in the urine. Porphyrins are pigments widely distributed throughout the plant and animal kingdoms. One of them, actioporphyrin, is the basis of chlorophyll, and another, protoporphyrin, is present in hemoglobin. Normally coproporphyrin is present in the feces, and small amounts of uroporphyrin, not detectable by ordinary laboratory methods, are present in the urine. Occasionally, under unknown circumstances, these substances are produced in excess and excreted in large amounts in the urine and feces, resulting in the clinical disease of porphyria. This overproduction is probably due to a reversion to an embryonic type of pigment metabolism.

Porphyria is usually divided into two types, congenital and acute. The latter is further subdivided into toxic and idiopathic forms. The congenital type is characterized by sensitivity of the skin to sunlight, discoloration of teeth and bones by uroporphyrin, and various types of skin lesions due to deposition of porphyrins in the skin.

The symptoms of acute porphyria include voiding of red urine, colicky abdominal pain, constipation, nausea and vomiting, hypertension, and various abnormalities of the nervous system, including psychic disturbances, peripheral neuritis, and ascending paralysis of the Landry type. The varied neurologic manifestations have recently been stressed by Hoagland,¹ who reported two cases in which extensive flaccid paralysis was present. The mortality rate is high, about 75 percent in patients presenting neurologic abnormalities. The pathologic changes in fatal cases are chiefly in the nervous system, and consist of degenerative changes in the peripheral nerves, spinal cord, and the ganglia of the autonomic nervous system, especially those of the abdominal viscera. Presumably the latter changes are responsible for the abdominal symptoms.

The toxic type of acute porphyria occurs in patients who have ingested certain drugs, especially sulfonal, trional, veronal, and other

¹ HOAGLAND, P. I.: Acute porphyria: report of 2 cases with neurologic manifestations. *Proc. Staff Meet., Mayo Clin.* 17: 273-280, May 6, 1942.

barbiturates, and occasionally sulfonamides. In these cases it is believed that the drugs merely precipitate acute porphyria in patients with a predisposition to a disturbance in porphyrin metabolism, and do not actually cause the disease. In the idiopathic type of acute porphyria, no precipitating factor or cause for the altered pigment metabolism can be found. In patients who recover, the pigment usually disappears from the urine in 3 to 4 weeks. There is no specific treatment. For the abdominal pain intravenous calcium gluconate has been recommended, and liver extract and ascorbic acid have been used, apparently on purely empiric grounds. In the toxic cases the precipitating drug should of course be discontinued.

Case report.—A Marine private, aged 22 years, was admitted to the hospital on 18 November 1943, 12 days after reporting for recruit training. The chief complaint was abdominal pain of 4 days' duration which had begun with mild intermittent generalized discomfort, increased steadily in severity, finally became colicky in character, and tended to localize in both lower quadrants.

The patient had had no spontaneous bowel movements since the onset of the pain, and two enemas given at the post dispensary before admission were ineffective. He had been nauseated since the onset and vomited four or five times in the 2 days prior to admission. The urine had been dark red for several days. There was no history of any similar previous attack, and the patient denied taking drugs at any time. His father had had diabetes for many years.

Physical examination showed the patient to be a well developed, well nourished young man, in obvious discomfort because of abdominal pain. His temperature was 99° F., pulse rate 68 per minute, and blood pressure 148/95. Positive findings were limited to the abdomen, where there was a broad operative scar in the right lower quadrant from a previous appendectomy. The abdomen was not distended. There was tenderness on palpation in both lower quadrants of the abdomen, but no muscle rigidity or masses. Rectal examination showed no abnormalities other than small external hemorrhoidal skin tags. The patient was noticeably tremulous, nervous, and apprehensive, but results of neurologic examination were otherwise negative. A specimen of urine was dark reddish-brown. Porphyrinuria was suspected and was confirmed by laboratory study.

A low-grade fever, up to 100.5° F., persisted during the hospital course. The colicky abdominal pain became more severe, and 2 days after admission was controlled only by morphine sulfate in doses of one-sixth grain. An x-ray of the abdomen at this time showed gaseous distention of many small intestinal loops, with some gas in the colon. Intravenous calcium gluconate did not relieve the pain, and the abdomen gradually became somewhat distended. Daily enemas were given, but the return flow was practically clear. The patient vomited repeatedly and intravenous fluids were administered. He remained very tremulous and apprehensive and was unable to sleep at night. Although it was realized that the abdominal symptoms were probably due to porphyrinuria, the clinical picture was sufficiently suggestive of intestinal obstruction that a surgical consultation was requested and it was decided to pursue a policy of watchful waiting.

The patient's condition remained unchanged until 23 November, 5 days after admission, when he had three generalized tonic and clonic convulsions in a 4-hour period. There was a positive Babinski's sign on the left side for a few hours after the third convulsion but subsequent neurologic examination showed no evidence of organic disease. No history of previous convulsive episodes could be obtained.

The following day an enema was effective, resulting in the first definite passage

of fecal material since the onset of illness 10 days previously. Coincident with this the abdominal pain decreased rapidly, as did the nausea and vomiting. Enemas were required to produce bowel movements for several days, and then mineral oil was sufficient. The tremors, insomnia, and apprehension decreased gradually. The blood pressure, which was 170/110 on 24 November, fell gradually to 140/100 in the next 6 days, and all readings after that were normal. The patient developed prolapsed external hemorrhoids which responded to palliative treatment. A low-grade fever persisted until 7 December. The reddish-brown color of the urine faded gradually, and from 6 December on it was normal in color and no porphyrins were detected. The patient was allowed out of bed on 15 December. His subsequent convalescence was uneventful, and he was discharged to duty on 10 January 1944, 2 months after onset of symptoms.

Laboratory studies.—The first specimen of urine showed a striking reddish-brown color. Tests for hemoglobin were negative, and no erythrocytes were found on microscopic examination. The port-wine color of the urine with deepening on exposure to light suggested the presence of porphyrins. The characteristic fluorescence of porphyrinuria was observed when the urine was placed under ultraviolet light, and was even noticeable when a test tube of urine was viewed in direct sunlight. Oxidizing agents such as potassium permanganate produced a deepening of the color. The normal amount of uroporphyrin presumably present in normal urines of other patients failed to produce similar positive results. No attempt was made to identify the type of porphyrin present. However the assumption is that it was uroporphyrin III since this is the substance ordinarily present in acute porphyria.

The port-wine color of the urine persisted until 6 December and did not recur. Urinalyses yielded otherwise negative results, except for slight albuminuria on two occasions and occasional mild glycosuria during the period of porphyrinuria. Fasting blood sugars were normal. A glucose tolerance test on 30 November, while porphyrinuria was still present, revealed a diabetic tendency. The fasting blood sugar was normal, 107 mg. percent, but blood sugar values 30 minutes, 1 hour, 2 hours, and 3 hours after the ingestion of 100 gm. of glucose were respectively 250, 321, 281, and 187 mg. percent, and large amounts of glucose were present in the last three urine specimens. A repeat glucose tolerance test on 7 December, the end of the period of porphyrinuria, showed normal blood sugar values, but there was slight glycosuria in the 1-, 2-, and 3-hour specimens. On 16 December the blood sugar values determined by a third glucose tolerance test were again entirely normal, and this time all urine specimens were negative for glucose.

Other laboratory studies, including blood sedimentation rate and blood urea nitrogen, were within normal limits. Repeated blood counts yielded normal results, except on the sixth day after admission when the leukocyte count was 14,000 per cubic millimeter with a normal differential count.

COMMENT

This patient presented most of the characteristic symptoms and signs of acute porphyria. The resemblance of the abdominal symptoms to those of partial intestinal obstruction was striking. As the patient had not taken any drugs prior to the onset of his illness, this case was evidently idiopathic.

An unusual feature of this case was the occurrence of three generalized convulsions on the ninth day of the disease. Since various types of disturbances of the central and peripheral nervous systems

occur frequently in acute porphyria, it seems reasonable to assume that these convulsive episodes were a part of the disease. There were no neurologic sequelae.

Another interesting feature of this case was the disturbance in carbohydrate metabolism during the period of altered porphyrin metabolism. As noted previously there was a slight glycosuria on several occasions. Further, although all tests for fasting blood sugar showed normal results, the glucose tolerance test during the acute stage definitely indicated diabetes. After the patient had recovered, however, the glucose tolerance curve was entirely normal. Since there was no evidence of derangement of carbohydrate metabolism after the porphyrin metabolism had returned to normal, it must be assumed that this temporary disturbance was due to, or at least partially precipitated by, the altered porphyrin metabolism. The paternal history of diabetes could indicate a potential vulnerability of the patient's carbohydrate tolerance, without which the porphyria might not have produced these temporary diabetic manifestations.

SUMMARY

A case of acute idiopathic porphyria, with apparent recovery, is reported.

Interesting features of this case were: (1) The resemblance of the abdominal symptoms and signs to those of intestinal obstruction; (2) the occurrence of three generalized convulsions without neurologic sequelae; and (3) a disturbance in carbohydrate tolerance with mild diabetic manifestations during the period of porphyrinuria, with subsequent return to normal.

Although porphyria is a rare disease, it should be borne in mind when a port-wine color of the urine persists without other discernible cause.



STRAIGHT LEG-RAISING TEST

With the patient in the recumbent position, the extended lower extremity is raised. The excursion of the extremity from the horizontal position to the position in which the patient first complains of backache, sciatic pain, or painful tightness of the hamstrings, marks out an arc which is recorded in degrees. During the test the leg must remain completely extended. The limitation in straight leg raising is recorded in degrees for both extremities. Inequalities in the value on the two sides are of greater significance than an apparently diminished value when the painful side only is tested, since the excursion varies with age and degenerative processes such as arthritis and previous trauma, and depends upon individual mobility.—PEYTON, W. T., and LEVIN, J. D.: Posterior herniation of intervertebral disc; analysis of sixty-five cases. *Minnesota Med.* 27: 264-271, April 1944.

PENICILLIN IN THE TREATMENT OF EMPYEMA FOLLOWING LOBAR PNEUMONIA

STEPHEN E. FLYNN

Lieutenant Commander (MC) U. S. N.

Past Assistant Surgeon Elisha Kent Kane, U. S. N., on his Arctic explorations in the years 1853, 1854, and 1855 used yeast as a poultice in all the infections that occurred among the crew. Today, almost 100 years later, another mold, *Penicillium notatum*, is widely used in the treatment of infections of various types. The following case demonstrates its success in a case of empyema after the sulfa drugs had proved ineffectual.

Case report.—A seaman, second class, 27 years of age, while on leave became acutely ill and complained of severe pains in his chest, difficulty in breathing and a feeling of soreness all over. He was admitted to a civilian hospital where physical examination revealed his temperature to be 101° F., pulse 102 and respirations 35. His pupils were dilated, the mucous membrane of the nose was injected, the throat inflamed and the tonsils were hypertrophied. The left lower lobe of the lungs was dull to percussion and there was tenderness about the consolidated area. No breath sounds were audible over the left lower lobe. The abdomen was distended and there was some rigidity over the upper left quadrant.

The white blood cell count was 18,400 with 81 neutrophils, 17 lymphocytes and 2 monocytes. The red blood cell count was 4,470,000, hemoglobin 80 percent, and the Wassermann negative. The urinalysis was negative except for the presence of a few red blood cells.

X-ray of the chest revealed a marked density of the left lung field extending up to the seventh rib, suggestive of unresolved pneumonia or the presence of fluid in the left pleural cavity.

The patient was given 40 grains of sulfadiazine immediately and then 15 grains every 4 hours. The second day of sulfa drug therapy the temperature dropped to 99.6° F. but began to rise gradually the next day. He was given sulfadiazine for 4 days. The patient's condition continued to regress and he had a dry non-productive cough. He became irrational and could not be kept in bed. He was given daily doses of 500 cc. of 10-percent dextrose intravenously. Opiates or barbiturates had no effect.

As a last resort following the fourth day of hospitalization 30,000 units of penicillin in an isotonic solution of sodium chloride were instilled into the pleural cavity after the withdrawal of 200 cc. of staphylococcus-positive fluid. This procedure was repeated the following day in addition to 25,000 units given intravenously every 4 hours. After the second administration of penicillin therapy the patient began to feel much relieved and the pain in his chest had subsided. His breathing began to return to normal. The patient was now given only intravenous penicillin 25,000 units every 4 hours.

On the sixth day of penicillin treatment the temperature was normal and the patient's chest was clear to percussion and auscultation. He appeared fully recovered from the empyema. Penicillin was reduced to one-half its initial dose after seven days of treatment.

The patient needed considerable convalescent care at that time and was transferred as an ambulatory patient to a Naval hospital for further treatment and disposition.

CONCLUSION

This was one of the cases in which the sulfa drug had no effect and penicillin was no doubt the factor that saved the patient's life.

It is my impression that in cases of empyema if penicillin is injected into the pleural cavity after withdrawal of the pus, a much quicker and more satisfactory result will be accomplished.



BLOOD SUPPLY OF NERVES

Hitherto more attention seems to have been bestowed on the nerve supply of vessels than on the vascular supply of nerves. The importance of the latter was, however, fully appreciated by some of the earlier anatomists and physiologists.

Anatomically the nutrient arteries of the nerves are not end-arteries, there being a continuous longitudinal anastomosis within each nerve. Some distinguish between "arteriae nutritiae" and "arteriae comites," though the latter, which may run in or on the nerve, sometimes give off arteriae nutritiae. From the practical standpoint a knowledge of the intrinsic vascular supply of nerves is valuable in relation not only to the regeneration of peripheral nerves but also to the severe symptoms which may follow ischaemia of nerves. Of practical significance, too, is the recognition that the intrinsic arteries of peripheral nerves are separately supplied by prolongations of the sympathetic system and are subject to changes in that system. These changes appear often to underlie such conditions as causalgia, post-traumatic spreading neuralgias, vasoconstrictor and vasodilator disturbances such as Raynaud's disease, angioneurotic oedema, angina pectoris, and some obliterative affections of the arteries and veins. If the facial nerve of the rabbit is devascularized *in situ* it loses its excitability in 15 to 30 minutes.

Okada produced degeneration of the sciatic nerve of the rabbit simply by dividing the inferior gluteal artery. This experiment is significant because it shows that the occlusion of a single regional vessel may exert a profound effect on the nerve which it supplies, and also that this type of degeneration—"ischaemic"—differs from Wallerian degeneration in that there is no actual interruption in the continuity of the axis cylinder. It has also been demonstrated that ischaemia need not be complete before it affects the transmission of both motor and sensory impulses. Moreover, by the use of a clamp, revascularization following a localized ischaemia produced by temporary pressure on a nerve is attended by recovery from paralysis and changes in the nerve which are interpreted as the subjective sensation of tingling. Further, the curative or alleviating effects claimed for such operations as division of the sensory root of the trigeminal nerve and excision of the stellate ganglion or its infiltration with novocain in the treatment of angina pectoris have their justification.—Editorial. Vascular supply of nerves. Brit. M. J. 1: 189-190, February 5, 1944.

CASE OF SULFONAMIDE REACTION

DUAL A. MACINTYRE¹
Lieutenant (MC) U. S. N. R.
CHARLES T. YARINGTON
Lieutenant (MC) U. S. N. R.
FRANK S. WHITE
Lieutenant (MC) U. S. N. R.
and
BYRNE W. MAYER
Lieutenant (MC) U. S. N.

A considerable literature has appeared on dermatitis medicamentosa caused by sulfonamides. Some of the manifestations verge on the bizarre. The present case illustrates the necessity for caution in the administration of the drug to patients who have a history of even a mild sensitivity.

Case report.—A Naval Reserve officer received an abrasion over the internal malleolus of the right leg. Subsequent infection resulted in a punched-out indolent ulcer, commonly called "desert sore."

For the next 3 months, during the Italian invasion, he was treated aboard a landing ship. The lesion was very slow in healing despite continuous treatment with sulfadiazine ointment alternated from week to week with gentian violet solution. Because of the profuse seropurulent discharge, sulfanilamide crystals were sprinkled on the lesion daily, and most of the time either sulfadiazine ointment or sulfanilamide was used in the dressings. As vitamins were unavailable vitamin therapy could not be instituted.

On 10 November the patient was seen in a Naval dispensary. The ulcer had healed but there was an itching area about three inches in diameter which was deep red, vesicular, and scaly. The scales were separated by fissures from which considerable serum oozed. The rash was diagnosed as dermatitis medicamentosa from sulfonamides. Chemotherapy was discontinued and the lesion rapidly improved.

Three weeks later the patient was admitted to this Naval dispensary with a diagnosis of cellulitis of the left eye and forehead following a laceration of the left eyebrow sustained 2 days previously when he bumped into a hatchway. Treatment was begun by local application of hot saline compresses and sulfanilamide. Again an incrustated lesion about 6 cm. in diameter appeared over the internal malleolus of the right ankle. There was a slight amount of serous exudate from the lesion.

Twenty-four hours after treatment was begun it was noted that the left side of the forehead and face became markedly swollen and the left eye was closed. Two gm. of sulfanilamide were given immediately, followed by 1 gm. every 4 hours. After 3 gm. had been taken there was increase in temperature from 99° F. on admission to 100.3° F. The pulse rate increased from 80 to 120.

¹ Deceased, Mediterranean area, 18 May 1944.

The lesion on the face became a spreading vesicular dermatitis. The lesion on the right malleolus increased in size, became vesicular, and small areas of macular, vesicular and bullous dermatitis appeared on the head, trunk, and extremities. The hands and feet became swollen and itched intensely. The reaction was most severe where the sulfa drug had been applied and at the site of the original lesion on the right malleolus.



Sulfonamide reaction.

Chemotherapy, both local and oral, was discontinued and in 48 hours the dermatitis had subsided, the lesions were remarkably improved, the temperature and pulse were normal, and the patient felt well.

Two weeks later, with no medication other than multiple vitamins, the lesions on the left forehead and eye still persisted but the vesicular eruptions were diminished in size and were drying and healing rapidly.

This patient showed initial skin sensitivity during local treatment, and later demonstrated an intense generalized reaction when sulfanilamide was given by mouth. It is interesting that the areas where sulfonamides had been used locally showed much more marked reaction than when the drug was given orally.

HERPES ZOSTER WITH MOTOR INVOLVEMENT

REPORT OF A CASE

G. BRUCE LEMMON, JR.

Lieutenant (MC) U. S. N. R.

The rarity of paresis as a symptom of herpes zoster and the confusion in diagnosis to which it might lead, are believed to warrant the presentation of the following case observed in a Naval hospital in the South Pacific. The complication is not even mentioned in discussions of herpes in several leading textbooks of medicine and dermatology.

Case Report.—The patient, a 23-year-old native Tongan, a sergeant in the Fiji Infantry, was admitted to the hospital complaining of pain and weakness of the right arm and shoulder. He stated he had had tonsillitis three times and dengue once. He denied venereal infection. He had had the regular atabrin prophylaxis, and said that he had felt well until 17 days before admission when he was awakened in the night by severe, deep, burning pain in his right shoulder and arm. At the same time he noticed a patch of painless blisters on the posterior aspect of the shoulder, and a small, firm, slightly tender lump on the side of his neck, near the blisters. These symptoms persisted and two nights later he had a severe chill and fever, which was gone by morning but was followed by weakness and pain on attempted motion of the entire right arm. This paresis progressed steadily. Clothes touching the lateral surface of the arm caused a burning sensation.

The patient had had no previous similar attacks and there were no similar cases in camp. He was referred to the hospital with the tentative diagnosis of acute poliomyelitis.

Examination revealed a patch of small, crusted lesions over the distribution of the right lateral supraclavicular nerve, and numerous slightly tender vesicles over the anterior aspect of the arm (resulting, according to the patient, from application of hot fomentations for relief of pain.) On the right side, over the distribution of nerves originating in the fourth, fifth, sixth, and seventh cervical segments, there was hyperesthesia, but loss of discrimination between sharp and dull sensations. There was almost complete paralysis of the right deltoid muscle, paresis and considerable pain on attempted contraction of all the muscles of the right arm and forearm, slight weakness of the trapezius, and definite atrophy of the supraspinatus and of the thenar eminence.

The biceps, triceps and radial reflexes were absent on the right side; Hoffmann, Babinski and Romberg signs were absent. The liver was enlarged two finger-breadths below the costal margin and was moderately tender; but no icterus was observed. The tonsils were moderately enlarged, inflamed, and cryptic.

No malarial parasites were found in two blood smears. There was leukocytosis of 11,150, with a normal differential count. The blood Kahn test was strongly positive.

During his 6-day stay in the hospital the patient was afebrile and his condition remained unchanged. Treatment consisted of the administration of analgesics and sedatives, vitamins, including oral and intramuscular thiamine chlor-

ide, and pituitrin. The patient was then evacuated to an Allied hospital. There spinal puncture was performed, yielding normal findings. An x-ray of the cervical spine showed no abnormalities. In order to protect the affected muscles, an abduction splint was used during waking hours and the arm immobilized in abduction at night. During the patient's 2-month stay at that hospital there was slight recovery of strength and the pain and paresthesias in the arm disappeared. Paralysis and pain of the shoulder persisted, however. No evidence of hepatitis was noted. After recovering from an attack of malaria, the patient was evacuated to the Fijis.

COMMENT

Except for the motor involvement, this patient's signs and symptoms displayed the usual picture of herpes zoster; burning pain and hyperesthesia, clusters of clear vesicles which become crusted, some systemic symptoms (fever, malaise, sometimes chills), and slight leukocytosis. The pain and systemic symptoms usually, but not always, precede the eruption.

The type and location of paralysis in this case coincides with that described by Taterka and O'Sullivan¹ in their exhaustive discussion of the condition. They report 44 cases collected from the literature, and arrive at several conclusions: The disease occurs most frequently in middle-aged or older males. The muscles of the upper extremity (the shoulder muscles in most cases) are involved in 45.5 percent of those paralyzed, the trunk muscles in 40.9 percent, and those of the lower extremity in 13.6 percent. The eruption precedes the paralysis in three-quarters of the cases, follows it in the remaining; they never appear simultaneously, the interval varying from a few days to a few weeks. In all of the cases the eruption and the paralysis were on the same side of the body, and in 90 percent they occurred in areas supplied by nerves originating in the same spinal segments. In 81.2 percent there is a diminished electrical response or a reaction of degeneration. There may be fibrillary twitching in the affected muscles. Only 16 percent of the patients recover completely, recovery requiring usually from 6 to 12 months. Two fatal cases have been reported; these developed into an ascending myelitis.

Herpes zoster is thought to be caused by a filtrable virus reaching the spinal cord, ganglia, posterior and even anterior nerve roots, either as an ascending neuritis or from the nose or throat via the bloodstream. The condition seems at times to follow trauma to the affected peripheral area, and sometimes accompanies systemic diseases, such as tuberculosis and syphilis. It may also result from direct irritation to the nerve ganglia or roots, as from a tumor.

In the present case the positive blood Kahn was discounted because of the absence of a history or signs of syphilis, a negative result

¹ TATERKA, J. H., and O'SULLIVAN, M. E.: Motor complications of herpes zoster. J. A. M. A. 122: 737-739, July 10, 1943.

from a spinal fluid Kahn test, and the fact that positive serologic findings are common and insignificant in the natives of Oceania. Because hepatitis was present, no antiluetic therapy was instituted at this hospital, and at the hospital to which the patient was evacuated, on the basis of vast experience with natives, the positive Kahn was considered of no significance.

Treatment of herpes zoster is largely symptomatic, but administration of vitamins, especially thiamine chloride, and pituitrin extract is thought to hasten recovery. If the underlying cause can be found, efforts to eradicate it should of course be made. In patients with motor involvement, absolute rest and protection by splinting of paralyzed muscles is recommended.



TWELVE RULES FOR MEETING BATTLE FEAR

1. Learn to know when you are becoming afraid.
2. Figure out in advance the best ways of meeting danger.
3. Keep remembering that being scared makes you a smarter soldier—and a safer one.
4. Keep your mind on the job and do it one step at a time.
5. The enemy is scared of you—and don't forget it.
6. Remember that your life may depend on somebody else's guts—and his on yours.
7. Remember too, if you lose, the enemy wins.
8. Never show fear in battle.
9. Make a wisecrack when you can.
10. Fear wears you out. So forget it when you can.
11. Don't hesitate to talk about being scared.
12. Have a good time when you get the chance. Fun combats fear—DOLLARD, J.: Twelve rules for meeting battle fear. *Infantry J.* 54: 36-38, May 1944.



PSYCHOGENIC FEVER

Most physicians are convinced that under certain conditions an emotional stimulus may induce an elevation of temperature. The slight rise so often observed at the time of admission to a hospital appears to be an example of this. In pediatric wards it is not unusual to find a number of slight elevations immediately after visiting hours.

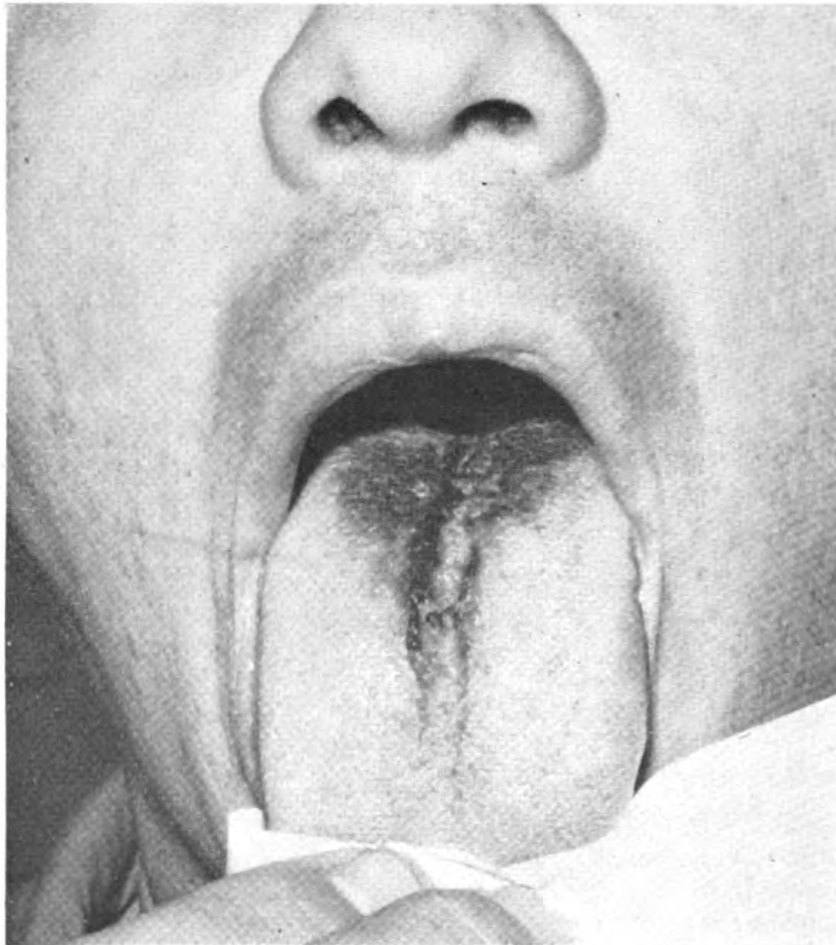
Wynn took the temperatures of 40 nurses immediately before and immediately after the writing of a state board examination, and found that the average was 98.9° F. before, and 98.3° F. after the examination. Similarly, he found that among 324 draftees who were awaiting physical examination for the army, the average temperature was 99.3° F., indeed 17 percent of the men had temperatures above 100.0° F. He attributed these elevations to anxiety and excitement.—BEESON, P. B.; *Fever. Clinics* 2: 1361-1393, April 1944.

LINGUA NIGRA

REPORT OF A CASE

RAYMOND D. LITTLE
Lieutenant (MC) U. S. N.

Lingua nigra or hairy black tongue is not seen frequently in general medical practice, and often goes undiagnosed. It is most often



Lingua nigra.

discovered accidentally by the patient, since there are no subjective symptoms.

The condition is characterized by a dark discoloration covered with hairlike processes over the dorsum of the tongue, and results in hypertrophy of the circumvallate papillae. The filiform processes usually are about 1 mm. in length.

The etiology of lingua nigra has been in controversy, some associating it with a fungus. Lederer in his text states the condition is usually

associated with poor oral hygiene, and is the result of hyperkeratinization of the filiform papillae which are impregnated by an iron compound. The black pigment is thought to be derived from foods and tobacco. The condition often disappears spontaneously. Mild antiseptics and improvement of oral hygiene are beneficial.

Case report.—A pharmacist's mate, first class, 24 years of age, reported to the dispensary complaining of loss of taste and a black tongue. He stated he had had a foul taste in his mouth for about 2 weeks, and for 1 week his food had not tasted natural. He had just returned from 1 year of duty in the Southwest Pacific and had had malaria nine times. He was a heavy smoker, using $1\frac{1}{2}$ to 2 packages of cigarettes daily.

Examination revealed the posterior part of the tongue to be covered with a black fur-like growth. In the center of the tongue was a reddish fissure. On closer examination the dark fur was found to be adherent to the tongue and could be scraped away only with difficulty. It had the appearance of numerous small hairs matted together. There was no soreness or tenderness of the tongue. The oral hygiene was good.

Scrapings revealed unbranched filaments with partition walls, which were thought at first to be a fungus, but cultures on Sabouraud's medium were negative for fungus.

The treatment consisted of topical application of 2-percent tincture of iodine twice daily. After 1 week of treatment the black coating of the tongue had disappeared and the tongue was normal in appearance.



AUTOFLUORESCENCE AND DIAGNOSIS

Filtered ultraviolet light excites in cells and tissues specific fluorescent spectra, a phenomenon known as autofluorescence, or primary fluorescence.

An attempt was made to determine whether different tissues fluoresce in specific colors and whether such specificity of colors can be employed in differentiating malignant from benign lesions.

The breast was selected as the first organ for study since there was a greater amount of material available and because it is in this field that the surgeon most frequently is confronted with the problem of making an immediate diagnosis to determine the extent of the operation to be undertaken.

It appeared that the primary fluorescence excited in these tissues by the filtered ultraviolet light used in this study might be employed by the surgeon, in the operating room in an examination of the fresh specimen, for the tissues are seen in a variety of colors, without fixation or staining. The architecture of the tissues under examination becomes sharply outlined. Small nodules, otherwise hardly visible, become clearly defined. Lymph nodes invaded by malignant cells apparently duplicate the fluorescent features of the primary tumor.

The attempt was made to differentiate between benign and malignant lesions by an application of these color phenomena.—HERLY, L.: Studies in selective differentiation of tissues by means of filtered ultraviolet light. *Cancer Research* 4: 227-231, April 1944.



EFFECT OF SALICYLATES ON THIAMINE EXCRETION

Salicylates give a blue fluorescence in ultraviolet light and therefore interfere with the thiochrome method of estimating thiamine. They are not removed by the usual preliminary extraction with isobutanol unless the solution has been made markedly acid.

Over short periods salicylates increase the excretion of thiamine in urine, but long periods of therapy cause a reduced output. It is suggested that a high thiamine intake is advisable during salicylate therapy.—CLELAND, J. B.: Effect of salicylates on estimation of thiamine by thiochrome method, on excretion of thiamine. *Australian J. Exper. Biol. & M. Sc.* 21: 153-158, September 1943.



PLASMA COLLOIDS IN BURNS

During experimental burns producing only an edema of the skin of dogs the concentration of serum albumin tends to fall. The globulin fraction also falls in relatively less severely burned animals which survive, but it rises, often to high levels, in fatally burned animals or in animals subjected to higher thermal stimuli. In thermal burns of 100° C. the diagnosis of hemoconcentration from the hematocrit value may be masked because of hemolysis.—LISCHER, C.; ELMAN, R.; and DAVEY, H. W.: Experimental burns: III. Changes in plasma albumin and globulin. *War Med.* 5: 43-45, January 1944.



PHYSIOLOGIC EFFECTS OF VERTICAL STANCE

Orthostatic hypotension, tachycardia, albuminuria, oliguria, flattening or inversion of the electrocardiographic T wave, depression of the motor and secretory functions of the stomach, and dysmenorrhea have all been attributed to the vertical stance. Failures in adaptation are occasionally so acute as to give rise to syndromes of pathological significance, but it has yet to be demonstrated that when these occur posture plays a decisive etiologic role.—HELLEBRANDT, F. A., and FRANSEEN, E. B.: Physiological study of vertical stance of man. *Physiol. Rev.* 23: 220-225, July 1943.

MEDICAL AND SURGICAL DEVICES

AN AID TO FOREIGN BODY LOCALIZATION

MARVIN L. GERBER
Lieutenant (MC) U. S. N.

Cole¹ has recently described an instrument to aid in the localization and removal of radiopaque foreign bodies. The instrument is used in conjunction with a fluoroscope to obtain three-point localization, thereby avoiding parallax. A workable modification of Cole's instrument was constructed which it is believed incorporates certain advantages.

The following conditions are generally accepted at present as indications for exploration after gunshot injury: Abscess; actual or potential interference with circulation, innervation or body kinetics; and presence of foreign body in a joint cavity. Contraindications for the removal of a foreign body are the presence of wound infection, shock, inadequate facilities for removal, and inaccessibility.

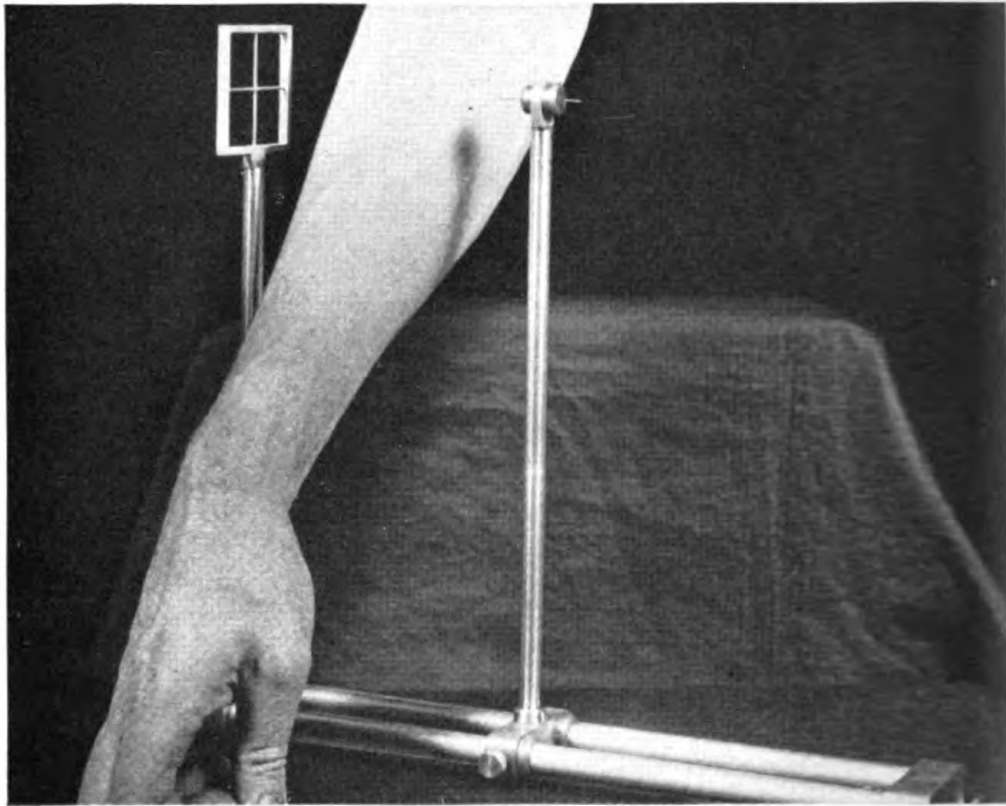
Surgical localization of a foreign body is frequently difficult, even when it is apparently palpable through the skin. Many instruments have been devised to aid in finding the particle at operation, but none has proved entirely successful for various reasons. Most of these utilize biplane fluoroscopy, although some ring bells and flash lights when a probe touches the metallic fragment in the tissues. The difficulty with this latter method is that considerable probing may be necessary, and the instrument may be so sensitive that it registers every time it hits some bone or fibrous tissue, or so hyposensitive that it fails to register when it touches the capsule which almost invariably invests every foreign body.

The advantages of the type of instrument about to be described are mainly its simplicity of construction and operation, and its accuracy of three-point localization. The instrument is 1 foot long, with an extension fitted with wire cross-bars intersecting 10½ inches from the base; the frame is 2 inches square. The other extension slides on the base, and is fitted with a ½-inch circle at the end, the midpoint of which is also 10½ inches from the base.

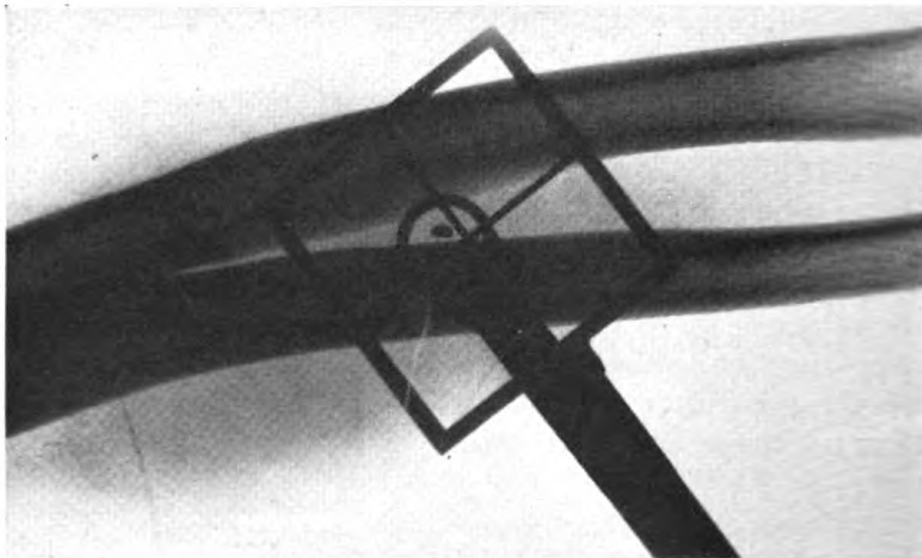
The extremity is placed between the calipers which are sighted under the fluoroscope so that the foreign body lies in a line between

¹ COLE, L. G.: Foreign body localization and extraction; description of a method more accurate than that used by the Army. *Am. J. Surg.* 60: 3-12, April 1943.

the intersection of the cross-bars and the circle. Marks can be made on the skin and the process repeated after 90° rotation of the extrem-



1. Device in position with grid on one side of body and nose-piece and needle on other side.



2. Showing foreign body between intersection of cross-bars and the circle.

ity. By this method there will be four marks on the skin. The fragment has to be at the intersection of these two imaginary lines.

As the incision is developed a piece of silk thread can be stretched between two corresponding marks, and exploration can be carried out from a third mark—the one closest to the object. The search is carried out by blunt dissection aimed toward the fourth mark on the inferior surface. It has been found that exploration is best carried out with the aid of a tourniquet under direct vision.

An attachment 1 inch long and flanged fits into the circular sight. It is bored through the center so that a needle may be passed through and automatically aimed toward the midpoint of the other caliper. With the instrument in place this needle can be inserted directly into the anesthetized skin and down to the foreign body; the instrument is then withdrawn and exploration is carried out with the needle in situ.



POSTOPERATIVE SALT INTOLERANCE

Three clinical types of "salt intolerance" are described.

Because of the relatively high incidence of "salt intolerance" following a general anesthesia, it is felt that no isotonic saline solution or Ringer's solution should be given during the day of operation and during the subsequent first two postoperative days. The fluid requirement of the patient is met with glucose solution. If a significant loss of extracellular fluid occurs during the above period, it is replaced with 0.5 percent sodium chloride solution to which 50 gm. per liter of dextrose has been added. Isotonic saline solution (0.9 percent) or Ringer's solution is used to replace extracellular fluid loss after the postoperative urinary suppression has disappeared, usually after the second postoperative day.

Great care must be used in administering isotonic saline and Ringer's solution to patients who are hypoproteinemic, anemic, acidotic, or oliguric.

It is recommended that the correction of uncompensated extracellular fluid deficiency states be made upon the basis of the physiologic response to test doses of the appropriate salt solution rather than upon the basis of the plasma chloride, the CO_2 combining power, the N. P. N., the plasma protein, or the hemoglobin levels.—COLLER, F. A.; CAMPBELL, K. N.; VAUGHAN, H. H.; IOB, L. V.; and MOYER, C. A.: Postoperative salt intolerance. *Ann. Surg.* 119: 533-542, April 1944.

A FLYING SUIT TO AID IN THE CONTROL OF HEMORRHAGE

RUSSELL G. WITWER

Lieutenant Commander (MC) U. S. N. R.

and

WILLIAM F. LEACH

Lieutenant A-V(T) U. S. N. R.

Combat pilots often return to their carriers or land bases with wounds that are bleeding freely. Many of them do not have the strength, means or time to control hemorrhage while flying the plane. The flying suit to be described here was designed in the hope that it would be of help in controlling hemorrhage. An effort was made to keep all materials used as simple as possible and of standard Navy issue so that practically any flying suit may easily be converted into the type described.

Four tourniquets are used, one in each arm and leg. They are 37 inches in length and $\frac{3}{4}$ inch in width. The lock is of lightweight aluminum, and has under it a 1- by 4-inch pressure pad made of felt. The tourniquets are kept in pockets sewn to the inside of the sleeves and pants, those in the sleeve being placed 5 inches from the armpit, and those in the pants 4 inches from the crotch. The locks are anchored in position. The only part of the tourniquet that is on the outside of the suit is about 5 inches of the cord; this allows ample room for a hand grip. A snap at the base of the cord and two 1-inch cloth bridges hold it in place.

The tourniquet is self-locking and can easily be released by slight pressure on the tab. It is accessible to either hand, and if necessary may even be tightened with the teeth. It does not interfere with flying in any way and is not uncomfortable to the wearer. The pads and locks are sewn into the suit so that they will create pressure over the large vessels of the arms and legs, and are placed so they do not come in contact with the parachute straps. The arm tourniquets must be placed at least 4 inches from the armpit or they will not provide

enough pressure to shut off circulation. It is believed that this flying suit could prove to be very valuable in combat areas. It is easily



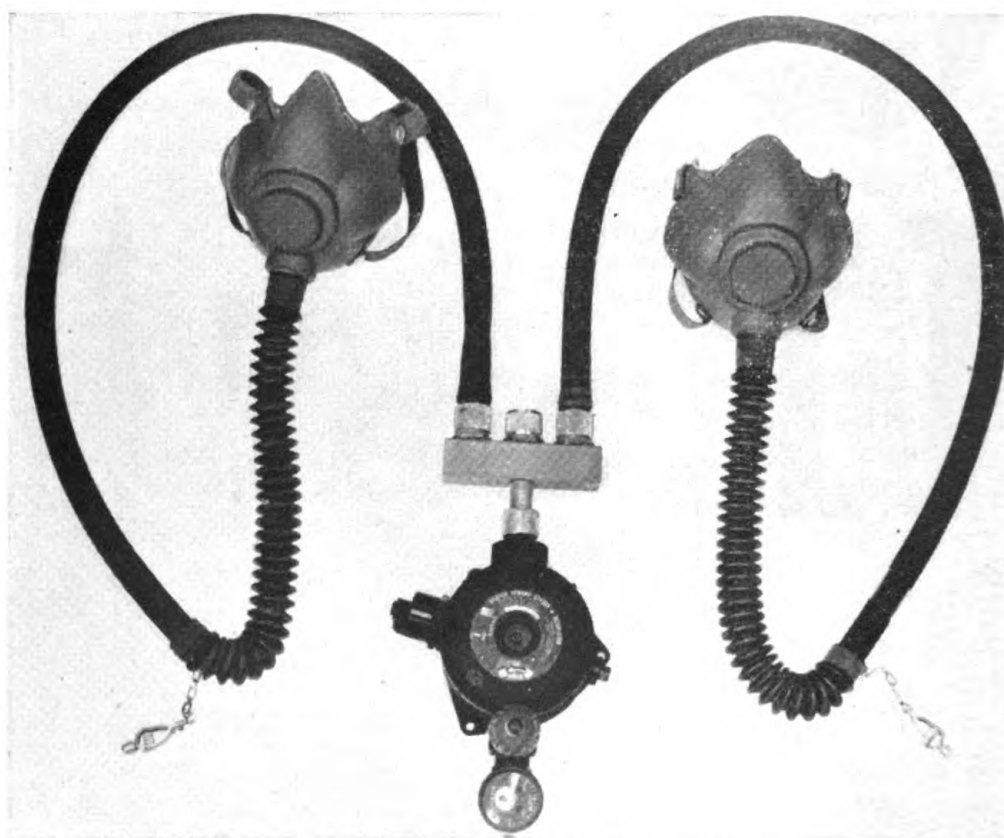
Tourniquet for flying suit. Strap 37 inches by $\frac{3}{4}$ inch. Buckle $2\frac{1}{4}$ inches long, 1 inch wide.

made, inexpensive, light in weight, and does not interfere with flying, and has been proved to stop the flow of blood in the upper or lower extremities. Any pilot can quickly learn how to use it, and should feel more at ease because of the added protection afforded by the suit.

DUAL DILUTER DEMAND OXYGEN REGULATOR¹

WILLIAM M. DAVIDSON
Lieutenant Commander (MC) U. S. N. R.

With the increase of high altitude flying and the use of oxygen equipment, safety measures to insure an adequate oxygen supply at all times are of paramount interest, and any feature which gives added



1. Use of the regulator with T manifold.

safety should be thoroughly investigated. Walk-around bottles with individual oxygen regulators are commonplace in our large planes; it is conceivable, however, that even such extra equipment might not be sufficient under all conditions. This study was undertaken in an effort to determine whether two men might possibly be sustained during an emergency on one oxygen regulator.

A T manifold was made which allowed two hose connections to come off the top of the T, the bottom of which was attached to the

¹ Received for publication 20 January 1944.

oxygen regulator (Pioneer) (fig. 1). Two demand Navy D masks were used by the subjects in all the tests. Routine runs using two men on one regulator were carried out as follows:

1. Two subjects and an observer were taken into the low-pressure chamber.

2. Pulse rates were taken at sea level, then at 18,000 feet, with the emergency valve (constant flow) open at a 5- and 10-minute interval.

3. The emergency valve was closed and the regulator was set on "diluter," after which pulse rates were taken by the inside observer at 5-minute intervals at varying altitudes up to 30,000 feet. All subjective symptoms and objective signs were noted.

4. The diluter principle cuts out at about 27,500 in this particular regulator; therefore above that altitude the equipment was working as a straight demand.

From results of tests made before adjustment of the diluter demand oxygen regulator, it was felt that adjustment of the regulator might increase the flow of oxygen and thus sustain two persons at oxygen altitudes. Without change in adjustment, however, two persons can be effectively sustained up to 18,000 feet.

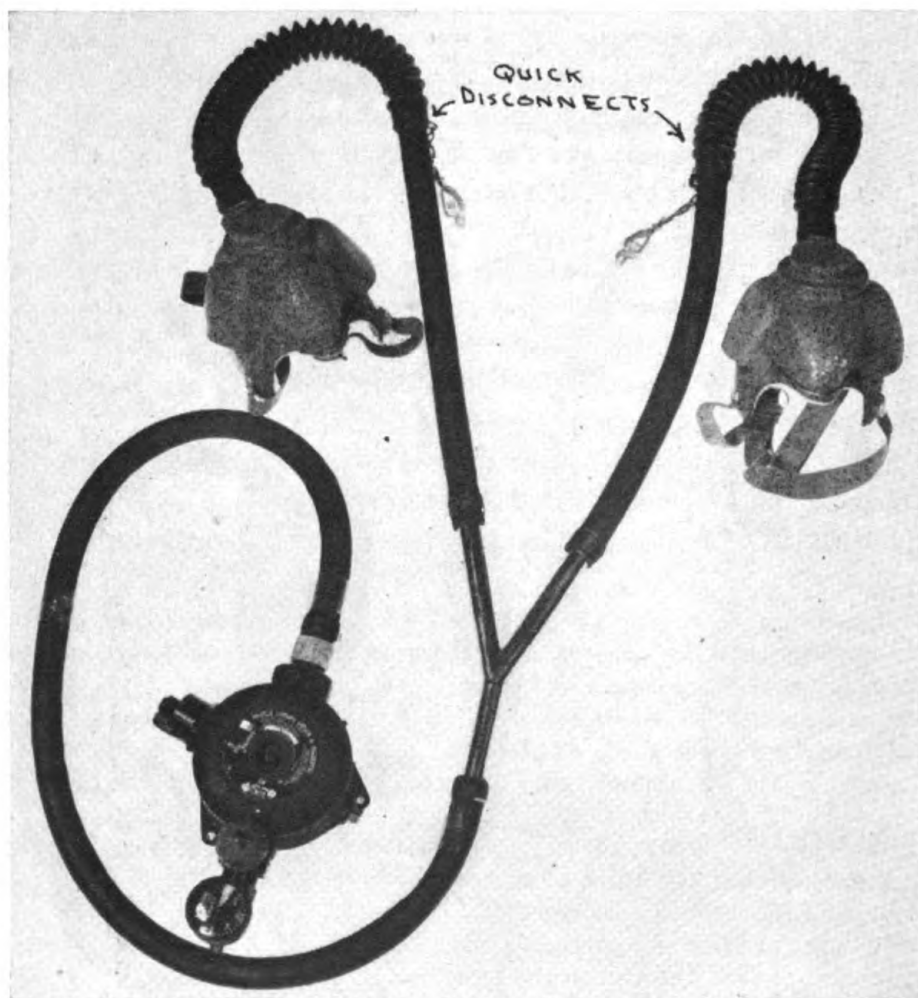
To effect change of adjustment of this regulator, the diaphragm lever must be made accessible and its set-screw reset. This disassembly and readjustment should be made in the following order:

1. Removal of the emergency valve knob.
 - a. Remove the screw and shakeproof lock washer from the top of the knob.
 - b. Carefully slide the emergency valve knob off the valve shaft assembly.
2. Removal of the diaphragm assembly.
 - a. Remove the four small screws around the diaphragm cover plate and carefully lift the cover off the case.
 - b. Unscrew the diaphragm knob and remove the lock nut. Lift off the diaphragm washer.
 - c. Unscrew the diaphragm by placing the palm of the hand over the diaphragm ring and turning it in a counter-clockwise direction.
 - d. Remove the lower diaphragm disk.
3. Readjustment of the diaphragm lever.
 - a. Loosen the lock nut around the set-screw.
 - b. Turn the set-screw in a clockwise direction until the end of the diaphragm lever is one-eighth inch above the edge of the case.
 - c. Hold the set-screw in place, and tighten the lock nut.
4. Replace the removed parts in the same order as they were disassembled.

By making the above readjustment, the oxygen is started flowing sooner and the demand valve is opened wider, allowing a greater flow through the regulator. It is this increased flow that makes it effective for two persons up to 30,000 feet. This readjustment has no noticeable effect on its operation when only one person is using it. However, an air-oxygen mixture test should be made to determine the actual change in flow through the regulator.

A practical consideration on using this principle in present oxygen

equipment needs to be considered. It was felt that a metal Y-fitting with the long hose connection to the regulator coming off the base of the Y, and the mask hose connections with quick disconnect fitting coming off the prongs of the Y, could be easily adaptable. Figure 2 shows this modification. This could be easily manufactured. Incorporation of a Y-fitting for use in emergency does not in any way affect the use of the equipment by one person.



2. Use of regulator with Y-tube connection.

CONCLUSIONS

1. Two men can be sustained at oxygen altitudes from one diluter demand regulator (Pioneer).
2. Adjustment of the set-screw controlling the diaphragm lever of the diluter demand regulator causes an increased flow of oxygen through the regulator.
3. A Y-tube connection arranged with quick disconnect fittings makes the mechanical adoption of this principle feasible.
4. Adoption of this principle would give an additional oxygen safety factor for personnel flying at oxygen altitudes in large aircraft.

SIMPLE TREATMENT FOR HEMORRHAGE INTO THE NAIL BED

WILLIAM J. SCHWAB

Lieutenant Commander (MC) U. S. N. R.

and

FRANK A. FOLEY

Lieutenant (DC) U. S. N. R.

Hemorrhage into the nail bed is a frequent occurrence about a rifle range, and is one of the commonest minor surgery problems at the dispensary. It is most frequently seen among recruits handling the U. S. rifle caliber .30 M1 for the first time, though occasionally a veteran will be "caught" so to speak. The injury is incurred by carelessly unlocking the piece and catching the finger (usually the right thumb) between the bolt and the shoulders of the chamber.

Hemorrhage is almost instantly produced, and due to the anatomy of the nail bed painful pressure is the first symptom, usually of an excruciating nature. If left untreated the blood is so slowly absorbed that infection frequently sets into this ideal culture medium.

Whenever hemorrhage of the nail bed of sufficient nature to produce pain is seen at this dressing station the procedure is as follows: The hands are washed with warm soapy water with special attention to the nail involved. The nail is then painted with any available antiseptic. The injured finger is placed on the bracket table of the dental unit with the nail up. A new No. 1/2 round bur is used in the straight handpiece. The bur is directed into that part of the nail below which the hemorrhage seems most profuse, and is allowed to feed itself into the nail without pressure, so that when penetration is accomplished the instrument does not injure the underlying tissues. No anesthesia is required.

The even pressure of the electrically driven bur is far superior to the hot needle, pointed scalpel, or other various technics employed. When there is enough hemorrhage to separate the nail from the bed there is no pain at all when the nail is punctured. After the blood has been released there is immediate cessation of the original pain. There has been no infection following this technic, and the unsightly split nails so frequently resulting in other technics do not occur.

It is believed that the technic outlined is simpler, less painful, faster, and gives a better result than other methods described. In military installations, where the apparatus is available, it offers a simple solution to a vexing minor surgical problem.

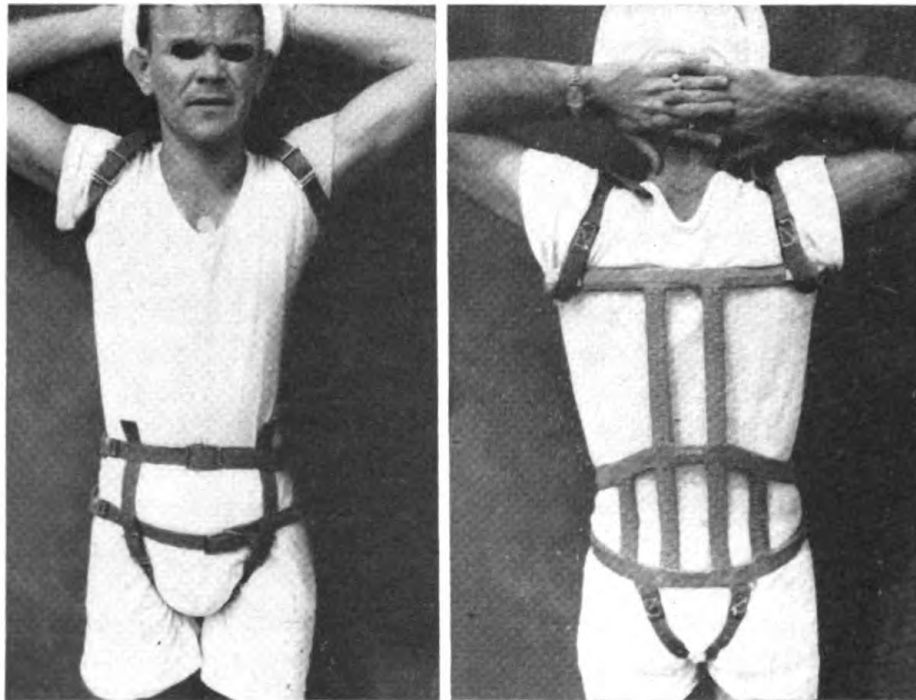
CONSTRUCTION OF BRACES IN THE FIELD

JOHN S. THIEMEYER, JR.

Lieutenant Commander (MC) U. S. N.

The orthopedic surgeon at foreign stations often finds himself handicapped in the handling of convalescent cases because of the lack of an adequate supportive brace, or the lack of facilities for having one made. It has been my experience that the ingenuity of Navy machinists under the guidance of the orthopedic surgeon will often fill this want, and satisfactory appliances can be fashioned with resulting saving of time, money, and transportation, which often is at a premium.

Case report.—A 29-year-old aviation machinist's mate, first class, was admitted to the service having suffered compression fractures of the bodies of the second



Improvised braces for vertebral fracture.

and third lumbar vertebrae with a fracture of the transverse process of the third lumbar vertebra with considerable separation of the fragments. The injury followed a crushing blow when an airplane engine under which the patient was working broke loose and fell directly on him, pinning him to the deck. There was immediate, almost complete paralysis of both lower extremities and marked diminution of the sense of touch of the skin of the same area. In addition there was a wide contusion of the dorsolumbar area of the back and laceration of the anal opening.

The patient was placed in a padded, hyperextension plaster of paris body cast. Two and one-half months later there was complete motion of the left leg and 10-percent decrease of flexion and extension of the right leg. There was no sensory disturbance of either leg and proprioceptive sense was good. The patellar, Achilles and scrotal reflexes were not obtainable on either side. There was no ankle clonus. The cast was bivalved at this time and with the patient remaining in the posterior shell, physiotherapy was instituted for return to an ambulatory state.

The patient requested that he not be transferred to the continental United States as he desired to remain with his unit. There were no facilities for making the necessary brace, but when inquiry was made as to the construction of the desired appliance, a chief aviation machinist's mate offered his services.

With the aid of proper detailed instructions, drawings and measurements, the brace was made in five days. It was fashioned from stock airplane, stainless steel strips skillfully joined and fitted. After a preliminary fitting, the frame was padded with felt which was secured by chamois wrapping sewed on with a "baseball stitch." Straps and buckles were attached as illustrated. These also were standard stock material.

The patient was permitted to be ambulatory, after x-ray studies, at the end of 3 months and wore the brace at all times when not in bed. He stated repeatedly that the appliance was very comfortable and offered good support. He went so far as to say that not infrequently he even wore it to bed to be doubly certain of a cure.

It is obviously not advocated that home-made devices should be used when professionally constructed ones are available, but frequently a situation arises which can be readily met by the craftsmanship of our own personnel.



BODY REACTION TO NIGHT WORK

Human beings have a twenty-four-hour cycle in many functions, in body temperature, in pulse, blood pressure, respiration, in oxygen use and carbon dioxide excretions, in the blood picture, in the excretion of water and solid substance, and in the function of the suprarenal capsule.

In normal life the temperature rises during the day, reaching its maximum between 5 and 8 p. m., falls during the night, its minimum occurring between 2 and 6 a. m.

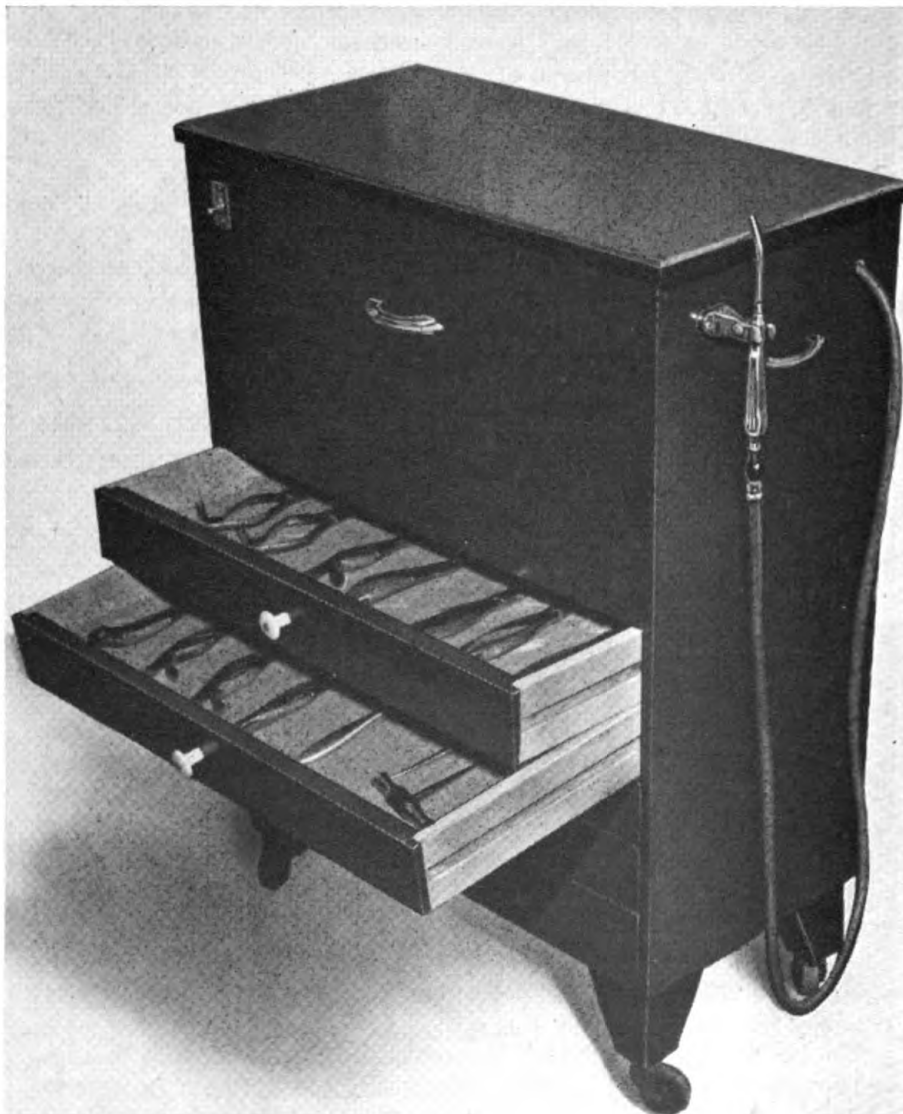
Night work causes either a tendency to reversal or a true reversal of the temperature curve, and possibly of some other rhythmic cycles of life.

The promptness with which inversion and reversion, that is, the adjustment in the thermal cycle, takes place is different in different individuals. But above all, it seems to depend upon the work done during the night. If there is physical work the inversion takes place within a week for most people; if essentially mental, the inversion seems to require a longer time. The reversion to a normal day cycle is more rapid than the inversion to the night rhythm.—PORTS, U.: Everyone can't do night work. Trained Nurse & Hosp. Rev. 112: 280-281, April 1944.

A PORTABLE DENTAL ASPIRATOR

SAMSTONE HOLMES
Lieutenant Commander (DC) U. S. N.
and
DONALD F. McCOY
Pharmacist U. S. N.

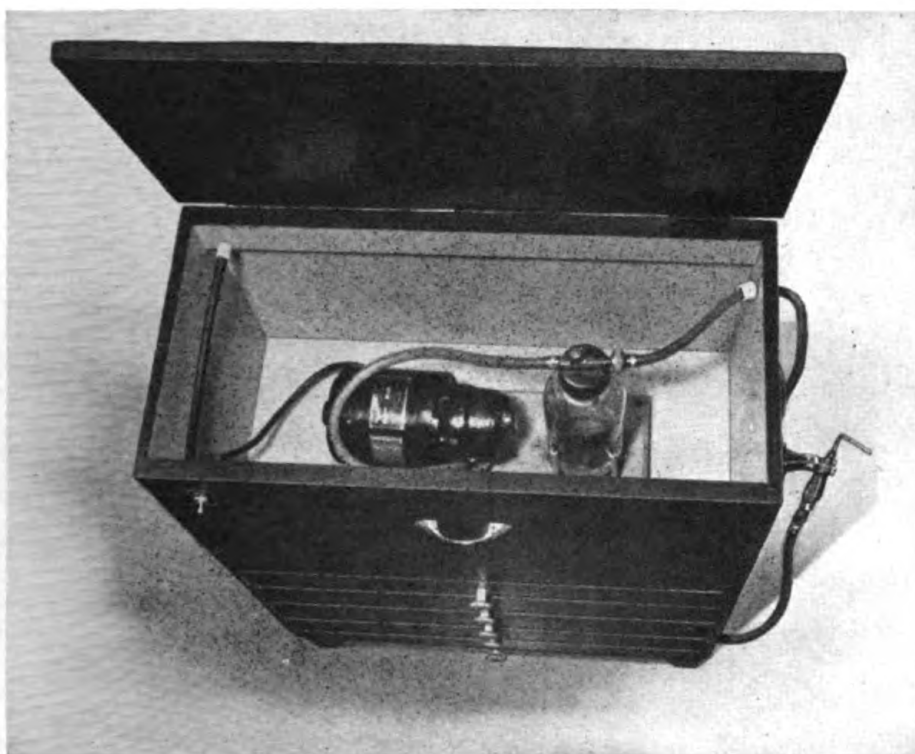
In an effort to make the dental aspirator available in all dental offices the aspirator and surgical cabinet were rearranged.



1. Showing aspirator in clip on the side of the cabinet and the interior of drawers with surgical instruments in place.

The aspirator unit which is designed to fit on the back of the Ritter Master Unit was removed from the dental unit and secured in the top

of the cabinet with suitable outlets for the aspirator tube and electrical wiring. When not in use the electrical cord is secured over hooks provided for the purpose on the back of the cabinet. An electrical switch was installed on the front of the cabinet so that the aspirator could be turned on and off after it had been plugged into the base outlet.



2. Showing the arrangement of the aspirator unit in the top of the cabinet.

The drawer space below is used for all dental surgical instruments. Casters assure ease in moving the cabinet from one dental office to another.

This piece of equipment has proved very satisfactory in this small dental clinic.



TIME INTERVAL AND Rh FACTOR

Almost all Rh negative individuals do not sensitize against the Rh factor when Rh positive blood is injected into them, or when they bear an Rh positive fetus. Only about 1 in 50 become sensitized, and these vary greatly in the ease with which they were sensitized. Some become sensitized after a single transfusion or at the very first pregnancy, while others require up to 10 or more transfusions or pregnancies before becoming sensitized.—COLLINS, C. C., and NICHOLSON, M. J.: Rh factor. *Anesthesiology* 5: 254-261, May 1944.

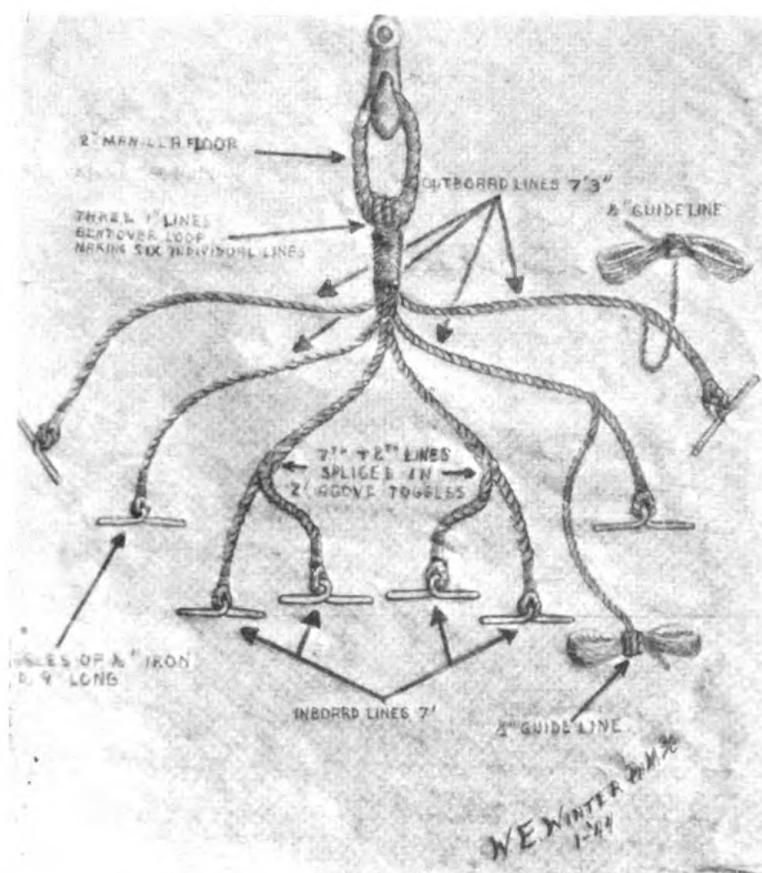
A UNIVERSAL TWO-LITTER LIFT

ROBERT C. WILLSON
Lieutenant Commander (D-M) U. S. N. R.

GEORGE MILLES
Lieutenant Commander (MC) U. S. N. R.
and

CHARLES N. MULLER
Chief Carpenter U. S. N.

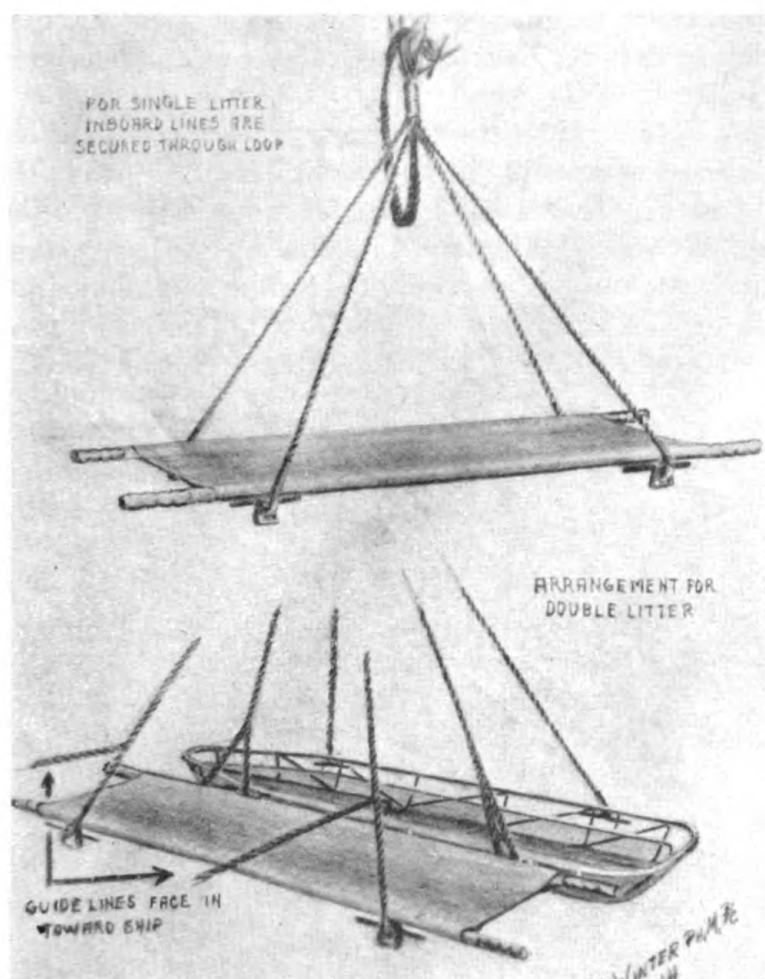
Assault transports have the care of casualties evacuated from the beach during amphibious operations as an auxiliary function to their



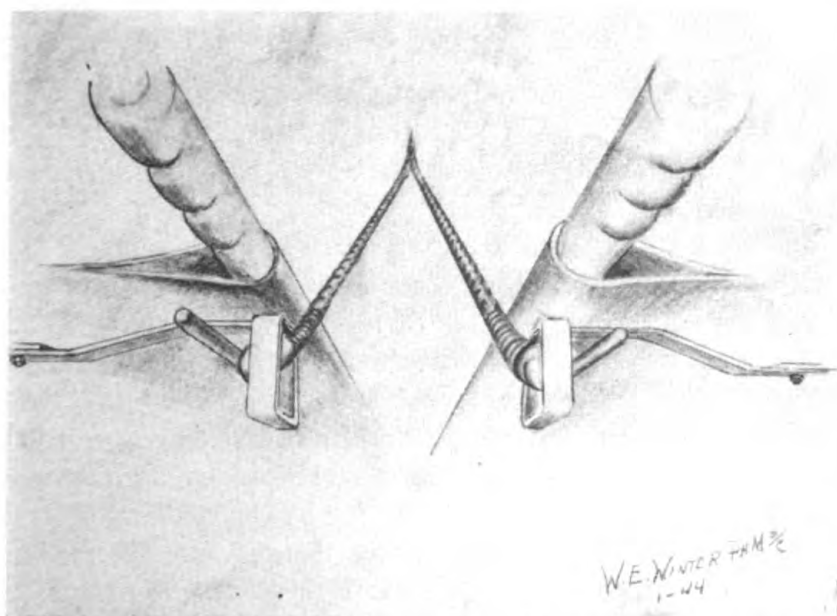
1. Universal two-litter lift.

role of combat loading transports, and occasionally they receive patients by transfer from other ships. These patients are transported to the ship in any of the various types of landing craft and are usually brought aboard in an open seaway, often at night when lights cannot be used and often in a rough sea.

Several types of platform and bar lifting devices have been evolved for the transfer of litter-borne patients from a boat to the ship's deck some 25 feet above. However these devices are heavy and cumber-



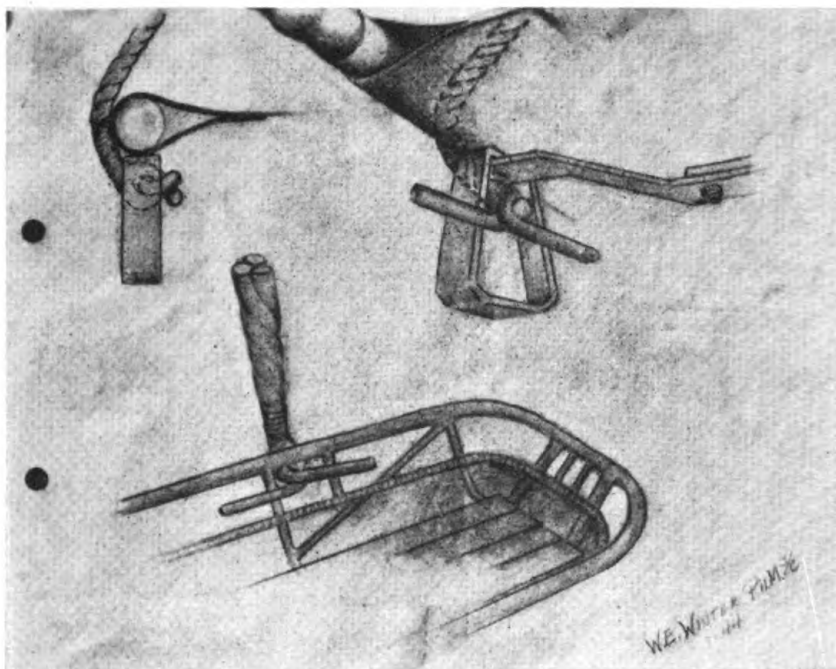
2. Universal two-litter lift secured to a single canvas litter and to a canvas and a Stokes litter.



3. Details of toggles secured to inboard legs of canvas litters.

some and necessitate shifting the litter cases in the narrow confines of the boat, so that they are impractical for use under the conditions described above.

A simple lightweight litter lift was devised aboard this ship. It was constructed of manila line and could lift two canvas litters simultaneously. It has been used to transfer more than a thousand litter-borne men, both in training and in actual operations, without an untoward incident, and has been adopted by the amphibious force. The usefulness of this Milles-Harris litter lift is limited by the fact that it is not adapted to lifting a Stokes litter. To overcome this objec-



4. Details of toggles secured to canvas and to Stokes litters.

tion a sister hook was secured to the end of each of the eight lines immediately above the loop. Although this modification permitted lifting either a canvas or a Stokes litter with the same gear, a simpler design was sought.

The desired results were achieved by replacing each of the eight loops with a toggle 9 inches long, made of a $\frac{1}{2}$ -inch iron rod. Each toggle was slipped through a leg of the canvas litter or through the frame of a Stokes litter. Two litters of either type or a single litter can be lifted. The litters have been tested with four men. To some extent the inherent safety of an all-manila line lift for men in the boat to whom it is being passed has been sacrificed by adding the metal toggles, but is more than compensated for by the advantage in simplicity and universal application achieved. In any case the patient must be secured to the stretcher by bunk straps or other safe means.

EDITORIALS

DIFFERENTIATION OF TISSUES BY MEANS
OF FILTERED ULTRAVIOLET LIGHT

Variation in the fluorescence of human tissues prompted Havlicek¹ over a decade ago to hang an ultraviolet lamp over his operating table in an attempt to make a differential diagnosis of various diseases. Why this practice was not generally adopted in the past requires some explanation. Certainly the potentialities of the method are apparent. Not infrequently the operating surgeon is faced with making an immediate decision relative to radical or conservative surgery. Under these circumstances any confirmatory diagnostic aid is keenly appreciated. The limitations of frozen section are well known. A biopsy is frequently not a reliable index of the exact histologic composition of a lesion and often the surgeon is forced to rely more upon his own judgment than on a pathologic report adverse to the apparent clinical evidence.

The differentiation of tissues by means of filtered ultraviolet light is not a new procedure. Fluorescence of blood has been employed in medicolegal investigations.² It has been found that in the presence of illness, blood serum fluoresced in a variety of colors, whereas in health it did not. Skin eruptions of contagious diseases, such as measles, are observed in ultraviolet light before they can be detected in ordinary light, and various dermatologic lesions are said to exhibit characteristic fluorescences. The differentiation between hyperkeratosis and psoriasis is possible by this procedure, and some dermatologists have utilized it to considerable advantage.

The examination of any tissue or organ by filtered ultraviolet radiation resolves that tissue or organ into its constituent elements. It is a macroscopic method of differentiating the various components of a specimen through variation in fluorescence. Areas not well demarcated under natural light are clearly visualized with filtered ultraviolet radiation. Areas appearing uniform both to palpation and to unaided vision will often show on examination under ultraviolet radiation a variegated appearance presenting several colors.³ Thus small nodules ordinarily invisible become apparent.

¹ Cited by HERLY, L.: Studies in selective differentiation of tissues by means of filtered ultraviolet light. *Cancer Research* 4: 227-231, April 1944.

² LOOFBOUROW, J. R.: *Medical Physics. Fluorescence: Methods.* The Year Book Publishers, Inc., Chicago, 1944. pp. 446-451.

³ SUTRO, C. J., and BURMAN, M. S.: Examination of pathologic tissue by filtered ultraviolet radiation. *Arch. Path.* 16: 346-349, September 1933.

The factors responsible for this fluorescence of tissues are not known. Among the theories advanced, that of the difference in ratio between the organic and inorganic matter in tissue merits special consideration and is confirmed by the micro-incineration of tissues.

Owing to the specific fluorescent spectra set up in cells and tissues by ultraviolet light, Herly endeavored to determine whether different tissues fluoresce in specific colors and whether such specificity of colors could be employed in differentiating malignant from benign lesions. More than 200 examinations of breast tissues were made in the operating room immediately after removal and photographic reproductions of the observed colors were obtained. The correlation between these observations and the microscopic diagnosis was consistently close, hence chance interpretation could be excluded.

Although the investigator admits the experimental stage of the study, the results warrant intelligent consideration. With the hurdling of cumbersome mechanical obstacles, the simplicity of analysis by fluorescence recommends it as a useful diagnostic adjunct and portends a more general adoption.

EARLY AMBULATION OF THE SURGICAL PATIENT

There was a time within recent memory when early ambulation of patients following major surgical procedures was frowned upon, most surgeons considering prolonged bed rest essential for the reparative forces of nature to heal tissues. It was common to find 18 to 21 days' hospitalization following uncomplicated herniorrhaphies, cholecystectomies and similar operations.

The surgeon who performed simple appendectomies under local anesthesia and permitted his patient to walk back to his room was labeled a showman. Reports of the European practice of getting surgical patients up in a chair on the third postoperative day were met with the retort that such practices would never be permitted in this country.

Perhaps experiences with dehiscant abdominal wounds made older surgeons wary of what were considered unorthodox methods of surgical management. Again the quality of suturing material precluded in many instances resort to early ambulation.

Advances in intestinal decompression, the perfecting of nonirritating sutures, and particularly the generally improved operative surgical technic have made these arguments for the most part untenable.

The occurrence of emboli and thrombi in surgical patients has dogged surgery's progress. These hidden unpredictable entities have

reduced all surgeons to a common denominator and taken the zest out of many otherwise technically perfect operations.

It was only recently however that researches have impressed the importance of early activity in the prevention of these galling experiences.

The postoperative program described by Lauer and Kerr in this issue of the *BULLETIN* (p. 232) gives positive information as to the extent and degree to which early ambulation can be followed with impunity. The minor discomforts of the patient, the pinching of stitches, cumbersomeness of dressings and the like are outweighed by the advantages of such a procedure. The mental reassurance and self-confidence that follow early postoperative getting out of bed offset the psychologic repercussions of undergoing an operation.

These experiences give significance to the new proposed treatment for acute dilatation of the stomach¹ and the practice of returning patients to full work status 15 days after herniorrhaphies.

With suitable precaution and some exercise of judgment it appears that the early ambulation of surgical patients has much to recommend its more general application.

FLASH-BURN PROTECTION

An important function of war research is the elimination of risks. Some risks however are inherent in the very prosecution of war and of necessity their conquest must lag behind the development of missiles of destruction. Flash burns are illustrative of this point.

Against the intense heat wave created by the tremendous explosive force of the modern bomb, energetic search has been instituted for a personnel protective dress. Development of a covering that will be protective and yet will not impede the movements of the wearer at battle stations has undergone a slow progression. It was found early that the wearing of a thin apron alone constituted a satisfactory covering. Now suits of various composition and design are available, their cost and practicableness influencing their general acceptance.

Aviators clothe in gear adaptable to the contemplated flight so it is hardly improbable that modern battle dress may include, as of old, a variety of battle armor.

Since ordinary clothing, however, affords protection against flash

¹ JOSEPH, E. G.: New treatment for acute dilatation of stomach. *Am. J. Surg.* 60: 381-385, June 1943

burns, the development of a protective film possessing the qualities described in this *BULLETIN* (p. 209) seems to cope satisfactorily with this perplexing problem. Quickly smeared over exposed parts the cream effectively eliminates burn hazards.

Care of the hands particularly during battle merits special emphasis. Burns of the hands are difficult in their therapeutic management and time consuming in their recovery. Flash constitutes a serious menace in this regard but burns from this source are preventable by the expediency of applying the glove film. Its smudge-proofness permits the handling of the finest instruments and maps and in no way does it interfere with the most delicate finger maneuvers.

Exposure to the devitalizing baking of direct tropical sun rays has added considerably to the sufferings of shipwrecked survivors afloat on a raft. How helpful the burn ointment is under these circumstances awaits confirmation. However it is known that the thinnest coat is an efficient sunburn cream, not readily removed by salt water or sweating.

The film has equalled the experimental demands imposed on it but awaits the crucial test of battle experience.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

MICROSCOPIC TECHNIQUE IN BIOLOGY AND MEDICINE, by *E. V. Cowdry*, Professor of Anatomy, Washington University, and Director of Research, The Barnard Free Skin and Cancer Hospital. 206 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$4.

Cowdry is so well known as a cytologist that his comments on technic are appreciated. A book by him on methods needs little further recommendation. However, he has again varied from the usual manner of presentation, and in preparing his manuscript has utilized several novel practices.

First, instead of the customary chapters, he has utilized the encyclopedic form with an alphabetic sequence. Second, he has two columns to a page and on unglazed paper. Third, there are no illustrations, tables, figures, charts or graphs. Finally, he has no introduction, but has launched his subject by commenting on the various methods of studying tissues, in vivo, in vitro, by tissue culture, and by micro-incineration.

In reading the book, it is essential to recall that the field of biology is also included. Nonetheless, most of the content is applicable to medicine.

Utilization of the text must assume some fundamental knowledge of microscopic technic; if in the hands of the beginner, there should be someone at hand to instruct the worker in principles and refer him to the sections on fixation, dehydration, clearing, embedding and in the selection of stains. As a companion volume to Mallory, to McClung or to Carleton and Leach, it would be of marked value. As a ready reference to the histologist, pathologist or medical technologist, it is even of additional worth.

The subject has been covered so thoroughly that it is not possible to offer any constructive criticism. The author has clarified the con-

fusion surrounding the different names applied to stains which are chemically similar. He has briefed his outlines of staining technic so as to include all in active use. His references are included under each separate heading.

This work should be at hand for every tissue technician and as time passes, he will find that he is relying upon it more and more.

A TEXTBOOK OF HISTOLOGY, Arranged Upon an Embryological Basis, by *J. Lewis Bremer, M. D., Hersey Professor of Anatomy, Harvard University*; rewritten by *Harold L. Weatherford, Ph.D., Assistant Professor of Anatomy, Harvard University*. 6th edition of "Lewis and Stöhr." 723 pages; 598 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1944. Price \$7.

Weatherford has taken over the revision of this, the sixth edition of one of the standard volumes on microscopic anatomy.

One of the most prominent changes is the addition of over 300 new illustrations. Many are in the form of photomicrographs, others are sketches and still others are attempts at demonstrating organs and tissues in three dimensions. Some are in color, but the majority are in black and white.

The author devotes a proper amount of space in the opening chapters to an intelligent presentation of the cell as a whole.

He leads the student through the complexities of the fundamental tissues, to which much of the book is devoted, and subsequently describes the development of these elemental structures into the various organs. The text remains primarily one of morphology, there being little attempt to correlate the physiologic aspects. Controversial subjects are avoided.

Sections especially to be recommended are those on Cytology, Bone, Vascular Tissue Including Blood, Endocrine Glands, and Teeth.

An unusually complete list of references is included. The binding, paper, print and drawings are all on a plane comparable to the material presented.

This book will remain one of the best to enable the student to achieve a basic knowledge of the cellular organization of the human body.

ELEMENTS OF MEDICAL MYCOLOGY, by *Jacob Hyams Swartz, M. D., Assistant Professor of Dermatology, Harvard Medical School and Postgraduate School*; introduction by *Fred D. Weidman, M. D., Professor of Dermatological Research, University of Pennsylvania*. 179 pages; 80 illustrations. Grune & Stratton, New York, publishers, 1943. Price \$4.50.

This comprehensive elementary survey of the pathogenic fungi, while stressing the laboratory aspects of medical mycology, presents considerable material of practical value even for those whose interest lies more largely in the clinical approach.

The high incidence of fungus disease among military personnel, particularly in tropical operations, warrants considerable emphasis on

a more thorough approach to the problem, and this small volume adds much to the present available material by its conciseness, its excellent illustrations, and its presentation of a practical, systematic and scientific approach to the problems of medical mycology.

It is regrettable that the author dismisses the problem of otomycosis with such brevity. This is one of the most pernicious mycologic problems encountered in tropical areas and, contrary to the author's treatment of the other mycoses, there are no suggestions for clinical management.

The volume is compact, well-bound, and well-printed both in text and in illustration.

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS, by *Edwin O. Geckeler, M. D.* 3d edition. 361 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$4.50.

To those already familiar with this book the third edition does not offer a great deal that is new. The chapters on immobilization and traction have been rewritten and expanded, and new ones have been added on fracture wounds and emergency treatment. Debridement of compound fractures is described in detail and the local implantation of sulfonamide is advocated. Gas gangrene and tetanus are briefly considered. The use of penicillin is not mentioned in the discussion of the treatment of sepsis and osteomyelitis. Over one hundred new illustrations are included in this edition.

For those not familiar with this book, it is a manual on the treatment of fractures and dislocations intended primarily for medical students and general practitioners. It is not complete enough to be of value to the service medical officer. The first portion is devoted to a general consideration of fractures and associated soft tissue injuries, with chapters on methods of immobilization and splinting, care of compound fractures, skeletal traction, complications, and aftercare. Operative procedures are only mentioned in passing with the exception of the insertion of Steinmann pins and Kirschner wires, the technic of which is described in detail.

Individual fractures are then considered as to diagnosis, treatment, complications, prognosis, and follow-up. The author does not attempt to describe a number of methods of treatment but gives for each particular fracture one method of handling which he has found to be satisfactory. This greatly simplifies the text and makes it valuable for quick reference. In general, skeletal traction in the treatment of fractures of long bones and the desirability of the use of plaster of paris for immobilization wherever practicable is emphasized. Its application for various types of casts is described in detail.

Dislocations are considered separately with a brief description of each of the various types. One method for the reduction of each is given and numerous illustrations help to clarify the manipulations.

The book is well bound and clearly printed on a good grade of paper in large-size type. Over 300 well chosen photographs, x-rays, and pen and ink sketches amply illustrate the text. A fairly complete bibliography is included.

THE ARTHROPATHIES—A HANDBOOK OF ROENTGEN DIAGNOSIS, by *Alfred A. de Lorimier, A. B., M. A., M. D., Colonel, Medical Corps, United States Army; Commandant, The Army School of Roentgenology, Memphis, Tenn.* 319 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1943. Price \$5.50.

This book represents an enthusiastic attempt to classify the various arthropathies, according to the etiologic concepts. It stresses the importance of correlating both the clinical and roentgenologic findings in arriving at a definite and final diagnosis. It is a challenge to the age-old terms of hypertrophic and atrophic arthritis, which are meaningless to the physician and of no value to the patient.

The knowledge of embryology of bones and joints is of great value in distinguishing the various developmental abnormalities from the other arthropathies.

It is unfortunate that the illustrative radiologic reproductions used in this book are, because of their size, lacking in detail and detract from the criteria which the author attempts to illustrate.

The omission of numbers on the plates throughout the book makes it exceedingly difficult to correlate the descriptive footnotes with the plates under discussion.

MANUAL OF THE DISEASES OF THE EYE FOR STUDENTS AND GENERAL PRACTITIONERS, by *Charles H. May, M. D., Consulting Ophthalmologist to Bellevue, Mt. Sinai and French Hospitals, New York; with the assistance of Charles A. Perera, M. D., Associate in Ophthalmology, College of Physicians and Surgeons, Medical Department of Columbia University, New York.* 18th revised edition. 520 pages; 387 illustrations including 32 plates with 93 colored figures. William Wood & Co., Baltimore, Md., publishers, 1943. Price \$4.

After two years this popular manual now appears in a new edition. It has been thoroughly revised, some of the text has been revised, some rewritten, and new illustrations, both in color and in black and white, have been added without increasing the size of the book.

The chapter on diseases of the lacrimal apparatus and the chapter on errors of refraction have been rewritten. The chapter on compensation for eye injuries has been brought up to date.

Of particular importance is the appendix giving the ocular requirements for admission to the Army, Navy, Marine and Air Corps of the United States.

It remains a clear and concise text of indispensable value to the student and the general practitioner. It is one book every member of the profession should keep in his library.

AN ATLAS OF ANATOMY—Volume I (Upper Limb, Abdomen, Perineum, and Lower Limb); Volume II (Vertebrae and Vertebral Column, Thorax, Head and Neck), by *J. C. Boileau Grant, M. C., M. B., Ch. B., F. R. C. S., (Edin.)*, *Professor of Anatomy in the University of Toronto*. 390 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$5 per volume.

The need for a good comprehensive atlas is real. It is not unusual to see the student dissectionist encompassed with a multiplicity of atlases, guides, and anatomy texts in order to comprehend the anatomic picture before him. It was therefore with considerable anticipation that the reviewer examined the present volumes. His disappointment however was keen when careful examination of the exquisite illustrations revealed appalling lack of detail. For example, in the diagram of the abdominal wall the transversalis fascia is completely omitted. In fact there is not a single reference to this all-important structure in the entire work. Moreover a number of rather prominent superficial nerves and vessels are not demonstrated, particularly in the region of the fossa ovalis femoris. In other illustrations they have been cut too short for the student to visualize their more general distribution.

The plan of the author in obtaining the illustrations is doubtless the answer to an ideal atlas, but unfortunately in this instance, too much detailed anatomy is sacrificed. The succinct legends and salient points for observation are advantages over other books of this type, and the orderly arrangement of the material is definitely commendable.

APPLIED DIETETICS—The Planning and Teaching of Normal and Therapeutic Diets, by *Frances Stern, Chief of Frances Stern Food Clinic, The Boston Dispensary; Assistant in Medicine, Tufts College Medical School*. 2d edition. 285 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$4.

It would be a most desirable thing if a book on dietetics were to be written which would correlate the advice of the physician as to a specific diet and an intelligent preparation by the patient of such a diet. Alas, the "Applied Dietetics" was an idea in the right direction, but has deviated in a too complicated and not always accurate approach to this problem. Most pointed is the chapter on "Construction of the Therapeutic Diet."

It is the prevalent opinion of the majority of gastro-enterologists that skin tests for food allergy are hardly accurate, and the author states that it is common practice to omit all food to which the patient shows a positive skin reaction. The author also states in the same chapter that veal and liver should be omitted. Why? It is the opinion and experience of the reviewer that food sensitive people get along splendidly on veal and liver.

In the chapter on "Typical Diet and Menus," the author increases the content of milk in the colitis diet. True, some colitis patients seem to tolerate milk well, but the majority do not. The author

emphasizes the environment and emotions in dietotherapy. The dietary charts with the accepted normals for foods, minerals, and vitamins are up to date and excellent.

FUNDAMENTALS OF CHEMISTRY AND APPLICATIONS, Chosen from Inorganic, Organic, and Biochemistry, with Applications in Everyday Concerns and in the Applied Sciences, Including Physiology, Cookery, Bacteriology, and Materia Medica, by *Charlotte A. Francis, A. M., Formerly Instructor in Chemistry, Teachers College, Columbia University*; and *Edna C. Morse, R. N., A. M., Instructor in Chemistry, Teachers College, Columbia University*. 2d edition. 537 pages. The Macmillan Co., New York, publishers, 1943. Price \$3.50.

This book is indeed a useful addition to any nursing school library. It is clearly though concisely written; it offers practical knowledge as well as scientific subject matter.

Throughout the book the illustrative drawings are excellent—simplified and interesting. The frequent correlation of the subject matter with human physiology is most valuable to a freshman nursing student.

A chemistry instructor in a school of nursing should find this volume a positive aid in her course planning. The subject and chapter divisions are logically arranged, and at the same time malleable, conveniently permitting her to use her own method of subject assignment.



DIATHERMY TREATMENT OF FIBROUS UNION FOLLOWING FRACTURE OF MANDIBLE

A seaman, second class, while on leave sustained a fracture of the mandible in the lower left molar area as a result of an automobile collision. He did not lose consciousness, and there were no other injuries. The jaw was immobilized 1 August 1943, at which time sulfa drugs and vitamins were administered. An abscess appeared on 15 August, which was opened and drained externally. The wires were removed at the end of 6 weeks. The jaw still had movement between the fragments, but on 24 October there was no crepitus or evidence of a faulty union.

A removable splint was applied and maintained in position until 10 December with no apparent improvement. The fistula had ceased to drain, and a hard lump, 12 by 25 mm., had appeared on the mandible at the site of the fracture. As a result of consultation with the physiotherapy department, it was decided to use diathermy as described by Schmitt. At the end of 2 months the union had become firm and the thickening at the fracture site was almost imperceptible. While it is not possible to prove the final calcification before 6 to 8 months have elapsed, the results thus far have been gratifying.—PATTERSON, L. F., Commander (DC) U. S. N. R., and KINNEMAN, R. E., Lieutenant Commander (MC) U. S. N. R.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

FAILURE OF PENICILLIN TO PREVENT SYPHILIS

CEDRIC C. CARPENTER

Lieutenant Commander (MC) U. S. N. R.

A quick and efficient method for the prophylaxis of syphilis has been eagerly awaited for many years. Stokes¹ in considering Gourget's attempts at prophylaxis with stovarsol and those of Fournier and Guenot in 1919 with arsphenamine and neoarsphenamine, concludes that "prophylaxis can hardly be said to have established itself." It is his belief that these methods should be restricted to patients with definitely known exposures and then administered within 2 to 3 days following contact. As the previously used chemotherapeutic agents have only proved themselves to be spirochetostatic and not spirochetocidal, the patient is liable to a delayed infection which may not become manifest for years.

Case report.—A 22-year-old ship's cook developed gonorrhea while at sea, 2 days following sexual contact. Physical examination showed the patient to be a well developed white male, apparently in good general health; physical findings were negative except for small nontender cervical and inguinal glands. There were no mucous patches in the mouth, there was no evidence of skin eruptions, and the anal area was free of any moist papules. On either side of the prepuce were dime-size shallow ulcers, with rolled, smooth, indurated edges and a hard infiltrated granulomatous base, which were moderately tender on manipulation.

He was treated with 4 to 6 gm. of sulfathiazole daily for 16 days with no apparent improvement. Because of the resistance of the infection the patient was hospitalized and was immediately given 10,000 units of penicillin every 3 hours for 5 doses, a total of 50,000 units. This stopped the urethral discharge in 72 hours and the patient was released from the hospital 1 month later. Within 2 days he developed two penile lesions on the prepuce which were indurated, ulcerated, and moderately painful.

The first darkfield examination was done 1 week after the patient's release from the hospital. Many spirochetes were observed in each field but none had the characteristics of treponema. Frei and Ducrey tests yielded negative results. Three days later another darkfield examination and a smear for Donovan bodies were made, and although some spirochetes were found, these were not considered as specific. No Donovan bodies were found in the leukocytes from the granulations. The blood Kahn was one-plus.

¹ STOKES, J. H.: Modern Clinical Syphilology. 2d edition. W. B. Saunders Co., Philadelphia, 1934. p. 565.

The patient returned for further observation in 2 weeks, during which time he had taken 4 gm. of sulfadiazine daily. During this interval one ulcer had almost healed but the Kahn, Kline, and Wassermann tests were strongly positive. Frei and Ducrey tests were also repeated and these were again negative in 48 hours.

Mahoney and his coworkers² emphasize that the time-dose relationship may prove to be as important in the treatment of syphilis with penicillin as it is with any other antisyphilitic chemotherapeutic agent. They caution, moreover, that minimal amounts of this drug may also fail to sterilize. These opinions are in agreement with Stokes' dictum that to be effective, prophylactic treatment must be administered in the first 2 to 3 days. In this case such treatment was not given until 22 days after contact. This patient's chancre was undoubtedly delayed 48 days by the administration of penicillin, confirming the observations of Gourget³ with stovarsol.

Certainly the 50,000 units of penicillin administered were inadequate when compared with the 1,200,000-unit dosage given in 8 days by Mahoney, Arnold, and Harris in treatment of darkfield and serologically positive primary infections. However, in this case the treatment was given at a time when no clinical symptoms were apparent and the complement fixation tests were negative, a stage in which ideally much smaller quantities of any chemotherapeutic agent would be necessary.

SUMMARY

A case is reported in which 50,000 units of penicillin were administered for a "sulfa-resistant" gonorrhea 22 days following exposure. This delayed the appearance of two clinically typical but darkfield negative chancres until the forty-eighth day and positive serologic findings until the seventy-second day. It is therefore suggested that patients with gonorrhea who have received penicillin therapy be given follow-up blood tests for several months before being considered free of syphilis.

² MAHONEY, J. F.; ARNOLD, R. C.; and HARRIS, A.: Penicillin treatment of early syphilis (preliminary report). *Ven. Dis. Inform.* 24: 355-357, December 1943.

³ GOURGET: Quoted by STOKES, J. H. p. 343.

SULFONAMIDE OINTMENT IN ROUTINE PROPHYLAXIS OF CHANCROID DISEASE

HERMAN S. ZEVE

Commander (MC) U. S. N. R.

and

SOL S. SCHNEIERSON

Lieutenant Commander (MC) U. S. N. R.

In the routine Navy prophylaxis for venereal disease, soap and water and calomel ointment have been considered effective against chancroid disease and syphilis. In this tropical area chancroids, pyogenic ulcers, some probably of fungus origin, and lymphogranuloma venereum are very prevalent, as could be expected with a predominantly colored and mixed population living under very poor sanitary and economic conditions. In spite of this routine prophylaxis, genital lesions other than chancres occurred frequently.

In view of the specific response of these diseases to sulfonamides and the increasing evidence of the efficacy of these drugs in oral chemotherapeutic prophylaxis, an effort was made to determine the value of the local application of a sulfonamide in the prevention of these venereal diseases.

For the past 9 months the following change in the routine prophylaxis was instituted. A mixed ointment containing one-third 5- or 10-percent sulfanilamide or sulfathiazole ointment and two-thirds calomel ointment was used, instead of the calomel ointment alone, in the final phase of the prophylaxis routine. During this period accurate records were kept of 10,368 prophylactic treatments given with the mixed ointment to nontransient personnel whose course could be followed.

The names and stations of all the men were recorded, together with the date of treatment and other pertinent information. Since then there have been only two men admitted from this group with a diagnosis of chancroid. However, in one of these patients the prophylaxis was recorded 26 days before admission and he may have had subsequent exposures without prophylaxis. In the other, treatment was recorded 2 days before admission, whereas no prophylaxis was recorded for an admitted exposure 2 weeks previously. During this period there were 70 other admissions for chancroid. It was ascertained that these patients had not received any prophylaxis or that they had had prophylaxis at other facilities where the sulfonamide-calomel routine was not employed.

There were three patients with primary syphilis admitted from this group who had records of prophylactic treatment. One admitted weekly exposures but had a record of only one treatment 29 days prior to admission. The second man had a record of two treatments 3 and 5 days after an admitted exposure but said that he had been exposed on other days. The third man had two recorded prophylactic treatments within 31 days and was admitted 15 days after the last prophylaxis.

Excluding gonorrhea, this represents the total number of cases of genital infections receiving this series of treatments. In the light of this experience, it is believed that the addition of a sulfonamide ointment to the calomel ointment treatment has greatly reduced the incidence of genital infections other than syphilis, and that the therapeutic effect on the prophylaxis of syphilis by calomel ointment has not been reduced by the addition of the sulfonamide. Oral medication with any of the sulfonamides has not been employed in this series.

As a result of our experience, it is believed that the addition of a sulfonamide ointment to the calomel ointment in the Navy venereal prophylaxis routine will enhance its protective ability against chancroid and other genital infections.



CAUSE OF PENTOTHAL FATALITIES

Pentothal, like all barbiturates, is depressant to the central nervous system, especially the respiratory center. By destroying the sensitivity of the respiratory center to its normal chief stimulus, carbon dioxide, under full pentothal anesthesia the body must make use of a supplementary mechanism to maintain respiration. Accordingly, a shift is made from the driving action of carbon dioxide on the respiratory center to the anoxemic stimulus which acts through the sino-aortic mechanism. The respiratory stimulation of pentothal may then be interpreted by uninformed anesthetists as an indication that the patient is waking up rather than that the patient is not getting enough oxygen, and a wrong interpretation here leading to the further administration of pentothal can cause the patient's death. Since the true depth of pentothal anesthesia is difficult to determine when there is a low oxygen content in the blood, the administration of oxygen with pentothal is always desirable and should certainly be done in the longer operative procedures. Since carbon dioxide is a depressant to respiration under pentothal anesthesia, its use as a respiratory stimulant in the treatment of respiratory depression caused by pentothal is contraindicated.—News and comment: Pentothal anesthesia. Bull. U. S. Army M. Dept. No. 76, 1-3, May 1944.

PREVENTION OF FOOD POISONING EPIDEMICS

GILLON M. COLE

Lieutenant (MC) U. S. N.

and

LOUIS SHATTUCK BAER

Lieutenant (MC) U. S. N. R.

Food poisoning epidemics continue to be an important cause of lost man-hours aboard ships and at shore stations of the Navy. This fact was again emphasized recently when 204 men out of a ship's crew of 460 became violently ill from eating turkey contaminated with *Salmonella gaminara*. The turkeys had been roasted at midnight and then allowed to stand at incubation temperature until served at noon the following day.

It is axiomatic that food poisoning epidemics can be prevented. Furthermore, Navy galleys are for the most part the epitome of cleanliness. Why then do epidemics continue to occur?

It is our opinion that the responsibility lies squarely on the shoulders of the medical department. We do not agree with Thomas and Syslo who in their excellent article on food poisoning in the Navy¹ state that the "burden of the problem rests with the commissary departments." We of the medical department may not be giving sufficient time to the education of the members of the commissary department in the bacteriology of food poisoning. Often we content ourselves with inspecting the galley, pointing out a greasy plate, a chipped cup, or a fork with a piece of food caught in the tines. (We know of no epidemic of food poisoning that has been traced to improperly washed eating utensils or chinaware.) We have assumed that exposing a man to a training course for sufficient time to enable him to pass a rating examination insures his understanding the causes and means of preventing food-borne epidemics.

Sixty-nine ship's cooks and bakers were asked to answer the questions listed below. Typical acceptable and unacceptable answers are quoted and the final results are tabulated.

1. *What is meant by the term "food poisoning?"* Acceptable answer: "Food poisoning is when food is taken into the body that has diseases in it." Not acceptable: "Anything that is no good."

2. *What are the most common causes of epidemics of food poisoning?* Acceptable answer: "One of the most easily contaminated foods is ham that has been cooked too long before serving and left at room tempera-

¹ THOMAS, G. E., and SYSLO, J. A.: Food poisoning in Navy, with deductions as to responsibility and prevention. Navy Training Course for Use in Preparation for Ratings of Ship's Cook, 2/c and Ship's Cook, 1/c. p. 232.

ture." Not acceptable: "Not wearing clean clothes; not being neat; not keeping your place where you cook and bake cleaned properly at all times." Answers which did not mention the important factor of allowing food to stand at room temperature for a long time before serving were not considered satisfactory.

3. *What are bacteria and how are they killed?* Acceptable answer: "Bacteria are germs that can be killed by heat." Not acceptable: The most frequent result here was a blank space.

SUMMARY OF RESULTS

Question	Acceptable answers	Unacceptable answers
1	20	45
2	30	39
3	59	10

We feel that the importance of cleanliness has been sufficiently stressed, but that the danger of leaving food at room temperature for a considerable period before it is served is not sufficiently understood and should be stressed repeatedly. It is not always possible to prevent pathogenic bacteria from contaminating food, but it is not impossible to serve foods soon enough after cooking to prevent the ingestion of harmful amounts of organisms or toxins. If this one cause of food poisoning alone were eliminated, 80 percent of food-poisoning epidemics in the Navy would be prevented.

Teaching the ship's cooks and commissary stewards the fundamentals of bacteriology and food-borne disease prevention should be done by a series of 20-minute weekly lectures and laboratory demonstrations. The amount of laboratory demonstration that will be practical will depend upon the size of the ship or station. It is obvious that these lectures must be brief and must be delivered in simple language. A suggested outline is as follows.

OUTLINE OF LECTURES ON FOOD POISONING

Lecture I—What are bacteria.

1. Their size and morphology.
2. How they reproduce and grow.
3. *Demonstration.*
 - a. Bacteria growing on agar, in nutrient broth.
 - b. Microscopic view of:
 - (1) Typical bacillus.
 - (2) Typical coccus.

Lecture II—How pathogenic bacteria get into food.

1. Difference between pathogenic and nonpathogenic bacteria.
2. Sources and routes of infection.
 - a. Throat.
 - b. Gastro-intestinal tract.
 - c. Skin lesions.
 - d. Infected animal tissues.

3. Demonstration.

- a. Throat culture.
- b. Stool culture.
- c. Culture of skin lesion. (These can be taken from the cooks themselves.)

Lecture III—Salmonella dysentery group.**1. Source of organisms.**

- a. Infected food.
- b. Human carriers.

2. Thermal death point.

- a. Danger of undercooked meat.
- b. Danger of letting food stand at incubation temperature.

3. Demonstration.

Cultures taken from meat immediately after cooking, 6 and 12 hours after standing at room temperature.

4. Description of typical epidemic, with chart showing this in graphic form.**Lecture IV—Staphylococcus.****1. Source of staphylococci contaminating food.****2. Toxin production.**

Brief explanation of difference between bacterial toxins and bacterial infections in relation to food poisoning.

3. Danger of leaving food infected with staphylococci at room temperature.**4. Demonstration.**

- a. *S. albus*, *aureus* and *citreus*.
- b. Staphylococci culture from infected food.

5. Description of typical epidemic with chart showing this in graphic form.**Lecture V—Streptococcus group.****1. Source of food infections.**

- a. Throat.
- b. Skin lesions.

2. Milk as usual medium.

The "mechanical cow" as possible source of epidemic.

3. Demonstration.

- a. Culture from milk properly pasteurized.
- b. Culture from milk improperly pasteurized.

4. Description of typical epidemic of septic sore throat, with chart showing this in graphic form.**Lecture VI—Summary.**

1. Summary of how to prevent food-borne epidemics.
2. Oral quizzing.
3. Question answering.

Typhoid fever, botulism, and chemical poisoning have been purposely omitted because they are not important causes of food-borne epidemics in the Navy.

CARBON TETRACHLORIDE POISONING

On a submerged submarine at 1130 a quart bottle of carbon tetrachloride was spilled in the after battery compartment. This was wiped up with rags which were placed in the galley garbage cans. (It is not known whether or not the cans were covered.) At 1230 the cook working in the galley became ill with headache and vomiting. At 1245 the duty officer in the control room became dizzy.

The ship surfaced at 1600, at which time the commanding officer was dizzy and vomited. Within a few minutes thereafter, eleven additional men had the same symptoms; thirteen others had headache and vertigo but did not vomit. Symptomatic treatment consisting of acetylsalicylic acid and spirits of ammonia was administered in the severe cases. The following morning, with the ship still at sea, all were free of symptoms, and no delayed complications had developed 2 weeks later.

While the possibilities of poisoning from the fumes of carbon tetrachloride cannot be ruled out, it is believed consideration should be given to the possibility of the symptoms having been caused by phosgene in an extremely low concentration. In favor of this hypothesis is the fact that the cook became ill while working in the galley 1 hour after the rags were thrown into the galley garbage cans. Then the affection spread to the control room, where 15 minutes later the duty officer was affected. It was not until 4½ hours after the spilling of the carbon tetrachloride when the ship surfaced that the commanding officer and 11 men became ill. Thirteen others had symptoms.

Alice Hamilton states in her book on industrial poisons that poisoning by carbon tetrachloride under certain conditions is really poisoning by phosgene gas. She further states:

Taking the maximum figures obtained as the most dangerous condition from the use of one quart of extinguisher on a fire in a 1,000-cubic foot space and comparing the figures with the concentration of gases that can kill a man by exposure for thirty minutes, the following results are obtained:

Gas	Maximum concentration found in 1,000-cubic-foot chamber (p. p. m.)	Kills a man after 30 minutes' exposure (p. p. m.)
CCl_4 (carbon tetrachloride)	6,673	48,000-63,000 (4.8-6.3%)
COCl_2 (phosgene)	43	25

The maximum figures represent very dangerous atmospheres for a person exposed thirty minutes, and undoubtedly exposures of 5 or 10 minutes might produce effects decidedly unpleasant and lasting, not to say serious.

The maximum toxic limits accepted as allowable for working in for 8 hours is 100 parts per million for carbon tetrachloride and 1 part per million for phosgene.

Considering the carbon tetrachloride concentration in the air as being heaviest in the galley, then spreading to the other parts of the submarine, we would find a very low concentration of this gas at the end of several hours. Comparison of 1,000 cubic feet with the cubic footage of the vessel and the dilution of the 6,673 parts per million, would give a toxic concentration only for a short time either at the place where the carbon tetrachloride was spilled or near the galley garbage can. It is believed, therefore, that the obvious gas was not the causative factor and the most likely other gas was phosgene, caused by the carbon tetrachloride in the galley coming in contact with the hot surface or heating units of the galley range.

This episode could have been prevented by putting the soaked rags in a sealed container and disposing of them upon surfacing.



TALCUM POWDER IN SURGERY

Talcum powder is, under any circumstance, a grave menace in surgery. Once having gained entrance into the animal organism, this powder sets up a reactionary, productive inflammation that is permanent and progressive and that may be provocative of almost insuperable complications. Furthermore, postoperative residual talcum has been demonstrated by one investigator in various intra-abdominal viscera in 80 percent of patients he examined.

It is certain that even meticulous care in washing off the surface of rubber gloves before operating does not guarantee against contamination of the operative field with talc.

The difficulty in substituting for talc lies in the fact that an insoluble powder like talc (hydrous magnesium silicate) sets up a granulomatous foreign body reaction, whereas a soluble dusting powder dissolves during the process of sterilization of the gloves, rendering them adherent and thus difficult or impossible to put on. Dry sterilization of the gloves might be regarded as a solution of this difficulty, but it does not meet the rigid requirements of aseptic surgery and is highly destructive to the life of the gloves. Boiled gloves are sloppy and generally undesirable.

Potassium bitartrate meets the physical requirements imposed by steam sterilization. It is readily and harmlessly disposed of by the body tissues and fluids.

Potassium bitartrate possesses a certain degree of bacteriostasis for the colon bacillus and *Staphylococcus aureus*.—SEELIG, M. G.; VERDA, D. J.; and KIDD, F. H.: Talcum powder problem in surgery and its solution. *J. A. M. A.* 123: 950-954, December 11, 1943.

“FOOD POISONING” FROM CADMIUM

Poisoning by the ingestion of cadmium salts dissolved in food has occurred in a number of instances, and may have been the causative factor in other food poisoning episodes in the Navy. Cangelosi (1) reported on three outbreaks caused by cadmium involving 218 men. Recently an outbreak believed due to cadmium incapacitated 70 percent of the personnel aboard a destroyer escort for at least 5 hours while on patrol duty, seriously impairing their operating efficiency during that time.

The ingestion of liquid or solid foods contaminated with soluble cadmium compounds is followed by a gastro-enteritis consisting of nausea, vomiting, abdominal cramps and diarrhea, very often with resulting weakness and prostration. The onset of these symptoms within 15 to 30 minutes in any group of persons is suggestive, yet in a few cases the symptoms may be delayed for as long as 5 hours. No fatalities have been reported in the literature (1) (2) (3) (4). In most cases, recovery ensues within 24 hours, but the inability to carry on normal duties may persist for several days.

Metallic cadmium is readily soluble in organic acids commonly found in foods, such as citric, lactic, tartaric, malic or acetic acids, even when in small concentrations (2) (3). Cadmium also dissolves to some extent in distilled water with acid pH. The organic cadmium salts formed when taken internally are thought to combine with the hydrochloric acid of the gastric juice, forming cadmium chloride. Cadmium chloride is known to be a powerful emetic, irritating the nerve endings in the gastric mucosa. Lewin (5) states that 0.03 gm. of cadmium sulfate by mouth will cause the symptoms described. The minimum dose lethal for man is not known.

Fruit beverages, tea, coffee, gelatin preparations, and fruit desserts ingested after contact with cadmium-plated utensils have been responsible for most of the civilian and Naval outbreaks reported. Any food or beverage which has an acid pH, or which becomes acid while in contact with cadmium, may be poisonous. In several of the reported instances in the Navy the incorrect use of a vacuum container for foods was found responsible for the poisoning. Despite the caution on the lid of this container: “Do not put food or beverage in this carrier without * * * pans made of non-toxic metal to hold the contents,” the directions were not followed. Thus, food placed in the cadmium-plated carrier directly without employing a pan of nontoxic metal became contaminated with cadmium.

Goldstone (6) describes a method of testing for cadmium which may be useful to detect cadmium-plated materials. The following reagents are required:

1. Ammonia-sodium nitrate reagent: 200 ml. of ammonia water (28 percent) plus 100 gm. of sodium nitrate diluted with water to 1 liter volume.
2. Sodium sulfide reagent: 100 gm. of sodium sulfide diluted with water to 1 liter volume.
3. Potassium cyanide reagent: 100 gm. of potassium cyanide diluted with water to 1 liter volume.

The test is performed as follows:

To a small pinch of the metal scrapings in a test tube, add 3 ml. of the ammonia-sodium nitrate reagent; bring the mixture to a boil over a flame and allow to stand for a minute or two. Pour the clear supernatant liquid into another test tube, add 1 ml. of the cyanide reagent, and after shaking add 1 drop of sodium sulfide reagent. This produces a canary yellow precipitate if cadmium is present. The metals, iron, tin, antimony, arsenic, silver, copper, nickel, chromium, zinc, and aluminum do not interfere. In the case of zinc or aluminum, a whitish gray precipitate is formed which is readily distinguishable from the canary yellow color of cadmium sulfide. If cadmium is present in addition to any of these metals, it is instantly detected. The only metals which do interfere are lead and mercury, but these are rarely, if ever, used as plating metals under these conditions.

Cadmium in food and vomitus may be detected by passing hydrogen sulfide into the wet-ashed solution of food or vomitus after it has been neutralized and made slightly acid (3) (6). The canary yellow precipitate of cadmium sulfide is formed. The necessary bacteriologic examinations are essential in eliminating bacterial contamination as the cause of an outbreak.

The prevention of cadmium poisoning by ingestion depends on keeping all foods, particularly acid ones, from contact with cadmium, under any circumstances. Cadmium-plated food containers should be used properly, or to avoid all possible errors, not at all. Cadmium should not be used in repairing metal-plated equipment which may in any way poison food or beverages.

REFERENCES

1. CANGELOSI, J. T.: Acute cadmium metal poisoning; report of 3 outbreaks. U. S. Nav. M. Bull. 39: 408-410, July 1941.
2. DIVISION OF INDUSTRIAL HYGIENE, National Institute of Health, U. S. Public Health Service. Cadmium poisoning. Pub. Health Rep. 57: 601-612, April 1942.
3. FRANT, S., and KLEEMAN, I.: Cadmium "food poisoning." J. A. M. A. 117: 86-89, July 12, 1941.
4. SCHIFTNER, J. J., and MAHLER, H.: Illness caused by cadmium. Am. J. Pub. Health 33: 1224-1226, 1943.
5. LEWIN, L.: Gifte und Vergiftungen. Fourth edition of Lehrbuch der Toxikologie. Stilke, Berlin, 1929.
6. JACOBS, M. B.: Chemical Analysis of Foods and Food Products. D. Van Nostrand, Inc., New York, 1938. p. 141.

NOTES ON OUR RESERVE CONTRIBUTORS

Arling, Philip A., Lieutenant (MC) USNR (*Treatment of Cerebrospinal Fever with Penicillin*, p. 281). B. S., College of Agriculture, University of Minnesota, 1931; B. M., 1940, and M. D., 1941, University of Minnesota Medical School. Agriculture Extension Division, University of Minnesota, summer months of 1929-35; county agriculture agent, United States Department of Agriculture, Jan.-June 1934; medical practice, Minneapolis, Minn., July 1941-April 1942.

Baer, Louis Shattuck, Lieutenant (MC) USNR (*Prevention of Food Poisoning Epidemics*, p. 393). B. S., University of Chicago, 1938; M. D., Rush Medical College, 1938. Intern, 1938-39, assistant resident, 1939-40, and resident in internal medicine, 1940-41, University Hospital, Ann Arbor, Mich.; instructor in internal medicine, University of Michigan Medical School, 1941-42. Member Michigan State Medical Society. Diplomate National Board of Medical Examiners.

Benson, Clifford D., Commander (MC) USNR (*Closure of Persistent Bronchocutaneous Fistula by Pedicle Muscle Graft*, p. 343). B. S., University of Wisconsin, 1926; M. D., Northwestern University Medical School, 1929. Intern, 1928-29, senior intern (surgery) 1929-30, resident in pathology, 1930-31, assistant resident in surgery, 1931-32, resident in surgery, 1932-33, Harper Hospital, Detroit; resident in thoracic surgery, Herman Kiefer Hospital, Detroit, 1933-34; instructor in surgery, 1937-40, and associate in surgery, 1940-42, Wayne University College of Medicine; private practice, Detroit, Mich., 1934-; associate surgeon: Children's Hospital of Michigan; Herman Kiefer Hospital; assistant surgeon: Harper Hospital; City of Detroit Receiving Hospital. Fellow: American College of Surgeons; American Medical Association; member: Michigan State Medical Society; Central Surgical Association; American Association for Thoracic Surgery. Diplomate American Board of Surgery.

Braun, Gustave S., Lieutenant, junior grade H-V(S) USNR (*Pes Cavus, Bilateral*, p. 346). Graduate chiropodist, School of Chiropody, Temple University, 1928. Private practice, chiropody, Pittsburgh, Pa., Aug. 1928-42; foot clinician, Children's Service Bureau, Pittsburgh, 1937-39. Member National Association of Chiropodists; Chiropody Society of Pennsylvania; Scientific Chairman, Western Division, Chiropody Society of Pennsylvania, 1940; fellow Pedic Research Society.

Brickman, I. W., Lieutenant (DC) USNR (*Toothache in the Low-Pressure Chamber*, p. 292). D. D. S., School of Dentistry, Washington University (St. Louis), 1941. Private practice, dentistry, Charleston, Ill., 1941-. Member: American Dental Association; Illinois State Dental Society.

Burhans, Robert A., Lieutenant Commander (MC) USNR (*Posterior Gonococcal Urethritis*, p. 278). B. S., 1927; M. A., 1928, University of Michigan; M. D., University of Michigan Medical School, 1929. Intern, Grace Hospital, Detroit, 1929-30; resident, Herman Kiefer Hospital, Detroit, 1930-31; private practice: Detroit, 1931-34; Lansing, 1934-43; chief urological department, Edward W. Sparrow Hospital, Lansing; consulting urologist: St. Lawrence Hospital; Michigan State College Hospital; Ingham County Sanatorium, Lansing. Fellow: American College of Surgeons; member: American Medical Association;

American Urological Association; American Neisserian Society; Detroit and North Central Branches of American Urological Association. Diplomate American Board of Urology.

Carpenter, Cedric C., Lieutenant Commander (MC) USNR (*Failure of Penicillin to Prevent Syphilis*, p. 389). M. D., George Washington University School of Medicine, 1928. Intern, Garfield Memorial Hospital, Washington, D. C., 1928-29; resident, Scripps Metabolic Clinic, La Jolla, Calif., 1930; house physician, New York Skin and Cancer Hospital, New York City, 1931-32; private practice, Summit Medical Group, Summit, N. J., 1932-43; attending dermatologist, Overlook Hospital, Summit. Fellow: American Academy of Dermatology; American Medical Association; member: Investigative Dermatologic Society; North New Jersey Dermatological Society (vice president); Union County Medical Society; State Medical Society of New Jersey. Diplomate American Board of Dermatology.

Cole, Thomas C., Lieutenant (MC) USNR (*Tendon Repair*, p. 241). M. D., University of Texas Medical Branch, 1931. Intern, 1931, and assistant resident, neuropsychiatry, 1932, City Hospital, Cleveland, Ohio; surgical resident, Evangelical Deaconess Hospital, Cleveland, 1933-34; general practice, Franklin, Texas, 1934-35; assistant physician, Texas Prison System, 1935-37; physician-in-charge, Texas Prison System, Huntsville, Texas, 1937-41; general practice, Palestine, Texas, 1942. Fellow American Medical Association; member: State Medical Association of Texas; Anderson-Houston-Leon Counties Medical Society.

Davidson, William M., Lieutenant Commander (MC) USNR (*Dual Diluter Demand Oxygen Regulator*, p. 368). B. A., University of Washington, 1929; M. D., University of Rochester School of Medicine and Dentistry, 1933. Intern, Mountinside Hospital, Montclair, N. J., 1934-35; physician-in-charge, Pan American Airways Second Pacific Expedition, 1936; private practice, Seattle, 1936-40; assistant surgeon, King County Hospital, Seattle, 1936-40; flight surgeon, Pan American Airways Alaska Division, 1939-40. Associate fellow Aero Medical Association; member: Seattle Chapter National Aeronautic Association (president, 1939-40); American Medical Association. Diplomate National Board of Medical Examiners.

Fauley, Gordon B., Lieutenant Commander (MC) USNR (*Prevention of Flash Burns by a Protective Glove Film*, p. 209). B. S., University of Chicago, 1925; M. S., Northwestern University, 1928; M. D., Northwestern University Medical School, 1929. Intern, Norwegian-American Hospital, Chicago, 1929; faculty member, Northwestern University Medical School. Fellow American Medical Association; member: Chicago Medical Society; Illinois State Medical Society.

Fetter, Ferdinand, Commander (MC) USNR (*Acute Idiopathic Porphyria*, p. 349). B. S., University of Minnesota, 1926; M. D., University of Minnesota Medical School, 1929. Resident, American Hospital of Paris, 1931; assistant physician: Philadelphia General Hospital, 1932-; Pennsylvania Hospital, Philadelphia, 1937-; Presbyterian Hospital, Philadelphia, 1933-37; associate physician, Presbyterian Hospital, 1937-; assistant instructor in medicine, 1933-35, instructor, 1935-41, and associate, 1941-, University of Pennsylvania School of Medicine. Fellow: American College of Physicians; American Medical Association; member: American Federation for Clinical Research; Philadelphia College of Physicians. Diplomate American Board of Internal Medicine. Contributor, Duncan's Diseases of Metabolism.

Fogel, R. Harwood, Commander (MC) USNR (*Genital Manifestations of Early Filariasis*, p. 263). M.D., Jefferson Medical College, 1930. Intern, Graduate Hospital of the University of Pennsylvania, Philadelphia, 1930-32; urologist; Maple Avenue Hospital, Du Bois, Pa.; Du Bois Hospital; consultant in

urology, Andrew Kaul Memorial Hospital, St. Marys, Pa. Member: American Medical Association; Pennsylvania State Medical Society; Pittsburgh branch of the American Urological Society.

Foley, Frank A., Lieutenant (DC) USNR (*Simple Treatment for Hemorrhage into the Nail Bed*, p. 371). D. M. D., Tufts College Dental School, 1930. Intern, Grasslands Hospital, Valhalla, N. Y., 1930-31; attending dentist: Tarrytown Hospital, Tarrytown, N. Y.; Mary Knoll Dispensary, Ossining, N. Y. Member: American Dental Association; New York State Dental Society; Ninth District Dental Society.

Friedrich, Eduard Georg, Lieutenant Commander (DC) USNR (*Processing Acrylic Dentures*, p. 297). D. D. S., Northwestern University Dental School, 1928. Research associate, histology and pathology, Northwestern University Dental School, 1940; private practice, dentistry, Chicago, Ill., 1928-. Member: American Dental Association; Chicago Dental Society; Illinois Dental Society.

Gillespie, Barnes, Lieutenant (MC) USNR (*Reception and Treatment of Casualties Aboard an Assault Transport*, p. 245). B. S., Bethany College, 1933; M. D., University of Virginia Department of Medicine, 1937. Intern, Union Memorial Hospital, Baltimore, Md., 1937-39; resident in surgery, Peninsula General Hospital, Salisbury, Md., 1939-40; fellow in pathology, Northwestern University, and resident in pathology, Evanston Hospital, Evanston, Ill., assistant surgeon, Riverside Hospital, Newport News, Va. Junior fellow American College of Surgeons; member: Medical Society of Virginia; Warwick County Medical Society.

Gouze, Frank J., Lieutenant Commander (MC) USNR (*A Spirometer Method for Determining Specific Gravity of Man*, p. 288). B. S., St. Edward's University, Austin, Texas, 1936; M. D., University of Minnesota Medical School, 1940. Intern, St. Mary's Hospital, Duluth, 1940-41; fellow, internal medicine, Minneapolis General Hospital, Minneapolis, Minn., 1941-. Fellow American Medical Association.

Hildreth, Harold M., Lieutenant H-V(S) USNR (*A Psychometric Procedure for Screening Mental Defectives*, p. 316). A. B., University of Nebraska, 1927; Ph. D., Syracuse University, 1935. Psychologist, Syracuse Psychopathic Hospital, Syracuse, N. Y., 1932-37; instructor, 1937-38, assistant professor, 1938-40, and associate professor, 1940-, Syracuse University. Member: American Psychological Association; American Association for Applied Psychology; American Association for Advancement of Science; American Orthopsychiatric Association.

Holman, Emile, Commander (MC) USNR (*Working Rules in the Field*, p. 253), A. B., Stanford University, 1911; B. A., Oxford, 1916; M. D., Johns Hopkins University Medical School, 1918. Instructor in surgery, Johns Hopkins University Medical School, 1920-23; Austin teaching fellow, Harvard University, 1923-24; assistant professor, surgery, Western Reserve University School of Medicine, 1924-25; associate professor, 1925-26, and professor, 1926-, School of Medicine, Stanford University; visiting professor, Peiping Union Medical School, 1930. Samuel D. Gross prize, 1930. Fellow: American Medical Association; American College of Surgeons; member: Society of Clinical Surgery; American Association for Thoracic Surgery; Pacific Coast Surgical Association; California Academy of Medicine; American Surgical Association; American Heart Association; Society for Experimental Biology and Medicine; Society of University Surgeons; Founders Group, American Board of Surgery.

Humphrey, Arthur A., Commander (MC) USNR (*Acute Idiopathic Porphyria*, p. 349). B. S. University of South Dakota; M. D., Northwestern University Medical School, 1928. Resident, Iowa Methodist Hospital, Des Moines, Iowa,

1928-29; fellow in pathology, Mayo Clinic, until 1932. Consultant in pathology to the Leila Y. Post Montgomery Hospital, Community Hospital, and the Battle Creek Sanitarium, Battle Creek, Mich.; consulting pathologist to the Michigan Community Health Project through the W. K. Kellogg Foundation. Member: American Medical Association; American Society of Clinical Pathologists; Michigan Pathology Society; State and County medical societies. Diplomate American Board of Pathology.

Huntington, Robert W., Jr., Lieutenant Commander (MC) USNR (*Genital Manifestations of Early Filariasis*, p. 263). B. A., Yale College, 1928; M. D., Yale University School of Medicine, 1933. Intern, Pediatric Service, New Haven Hospital, 1932-33, assistant resident, 1934-35; special work in clinical bacteriology, Dept. of Pediatrics, Yale University School of Medicine, 1933-34, under Powers fellowship grant; Theron Catlin fellow in infectious diseases, St. Louis Children's Hospital and Washington University, Dept. of Pediatrics, St. Louis, Mo.; assistant physician, St. Louis Children's Hospital, 1935-38; instructor in pediatrics, Washington University, 1937-38; research in tuberculosis under grant from International Health Division, the Rockefeller Foundation; instructor in pathology, Cornell University Medical College, 1938-41. Member Society of American Bacteriologists; American Society of Tropical Medicine. Diplomate National Board of Medical Examiners.

Janetos, Dion S., Lieutenant Commander (DC) USNR (*"Trench Mouth" Aboard a United States Naval Auxiliary Vessel*, p. 308). D. M. D., Tufts College Dental School, 1941. Intern, Boston Dispensary Aug.-Jan. 1944. Member: American Dental Association; Massachusetts State Dental Society.

Keck, Alfred J., Lieutenant (DC) USNR (*Fixed Anterior Acrylic Restorations*, p. 301). B. S., Manhattan College, 1930; D. D. S., School of Dental and Oral Surgery, Columbia University, 1934. Intern, New York City Hospital, 1934-35; staff member: New York City Hospital; Knickerbocker Hospital, 1935-36; private practice, dentistry, New York City and Walden, N. Y. Member: American Dental Association; Ninth District Dental Society; Orange-Sullivan Dental Society.

Kerr, Richard K., Lieutenant Commander (MC) USNR (*An Ambulatory Program Following Operation for Unruptured Appendicitis*, p. 232). B. S., Northwestern University, 1934; M. D., Northwestern University Medical School, 1938. Intern: Charity Hospital, New Orleans, La., 1938-39; Vanderbilt University Hospital, Nashville, Tenn., 1939-40; volunteer assistant pathologist, Boston Lying-in Hospital, 1940-41; resident obstetrician, Millard Fillmore Hospital, Buffalo, N. Y., 1941.

Lauer, Calvin A., Lieutenant Commander (MC) USNR (*An Ambulatory Program Following Operation for Unruptured Appendicitis*, p. 232). M. D., University of Illinois College of Medicine, 1928. Intern, Cook County Hospital, Chicago, 1928-30; resident surgeon, St. Luke's Hospital, Chicago, 1930-31; assistant instructor in anatomy, University of Illinois, 1929-31; private surgical practice, Long Beach, 1931-; attending surgeon: Los Angeles General Hospital, Los Angeles; Seaside Memorial Hospital, Long Beach; Long Beach Community Hospital; surgical consultant: Norwalk State Hospital, Norwalk, Calif.; Tichenor Clinic, Long Beach. Fellow: American College of Surgeons; American Medical Association; member: Los Angeles County Medical Society; California Medical Association. Diplomate American Board of Surgery.

Lemmon, G. Bruce, Jr., Lieutenant (MC) USNR (*Herpes Zoster with Motor Involvement*, p. 357). A. B., Dartmouth College, 1938; M. D., Washington University School of Medicine (St. Louis), 1941. Intern, George F. Geisinger Memorial Hospital, Danville, Pa., 1941-42.

- Logan, Victor W.**, Commander (MC) USNR (*Acute Infectious Hepatitis*, p. 271). A. B., Princeton University, 1923; M. D., Cornell University Medical College, 1927. Intern, New York Hospital, New York City, 1927-29; instructor in clinical medicine, Cornell University Medical College, 1930-34; assistant physician, 1934-, and gastro-enterologist, 1936-, out-patient department, Roosevelt Hospital, New York City; assistant attending physician, Roosevelt Hospital, 1936-. Fellow: American College of Physicians; American Medical Association; New York Academy of Medicine; member: Medical Society of the State of New York; New York County Medical Society. Diplomate American Board of Internal Medicine.
- Longenecker, Charles R.**, Lieutenant Commander (MC) USNR (*Acute Idiopathic Porphyria*, p. 349). B. S., Pennsylvania State College, 1928; M. D., Johns Hopkins University School of Medicine, 1932. Intern: Hospital for Women, Baltimore, Md., 1932-33; Long Island College Hospital, Brooklyn, N. Y., 1933-34; resident physician, surgical service, Coney Island Hospital, Brooklyn, N. Y., 1934-36; assistant surgeon, Long Island College Hospital; lecturer, fracture service, New York Polyclinic Hospital, New York City. Member New York County Medical Society.
- Macintyre, Dual A.**, Lieutenant (MC) USNR (*Case of Sulfonamide Reaction*, p. 355). A. B., Union College, 1934; M. D., Albany Medical College, 1939. Intern, 1939-41, and resident in surgery, 1941-42, Meadowbrook Hospital, Hempstead, N. Y. Diplomate National Board of Medical Examiners, 1941. Deceased, Mediterranean area, 18 May 1944.
- Milles, George**, Lieutenant Commander (MC) USNR (*A Universal Two-Litter Lift*, p. 376). Ph. G., 1921, B. S., 1925, University of Illinois; M. D., 1929, M. S. (pathology), 1932, University of Illinois College of Medicine. Intern, Kings County Hospital, Brooklyn, N. Y., 1927-30; assistant professor of pathology (on leave of absence), University of Illinois; director of laboratories, Augustana Hospital, Chicago; staff member: Augustana Hospital; Lutheran Deaconess Home and Hospital, Chicago. Fellow American Medical Association; member: Illinois State Medical Society; Chicago Medical Society; Chicago Pathological Society; American Society for Clinical Pathologists. Diplomate American Board of Pathology.
- Murphy, Willis A.**, Lieutenant (MC) USNR (*Study of Albuminuria in Applicants for Naval Enlistment*, p. 321). M. D., New York University College of Medicine, 1932. Associate visiting physician, Bellevue Hospital, New York City; physician, out-patient department, New York Hospital; instructor in medicine, Cornell University Medical College. Associate American College of Physicians; fellow: American Medical Association; New York Academy of Medicine; member Medical Society of the State of New York. Diplomate American Board of Internal Medicine.
- Owens, J. Cuthbert**, Lieutenant, junior grade (MC) USNR (*Reception and Treatment of Casualties Aboard an Assault Transport*, p. 245). B. S., College of William and Mary, 1936; M. D., Marquette University School of Medicine, 1941. Intern, Cincinnati General Hospital, Cincinnati, Ohio, 1941-42; assistant resident in surgery, Henry Ford Hospital, Detroit, 1942-43. Diplomate National Board of Medical Examiners.
- Parker, Leon O.**, Commander (MC) USNR (*Occupational Therapy in a Naval Hospital*, p. 325). B. S., Indiana University, 1924; M. D., Indiana University School of Medicine, 1926. Intern: United States Marine Hospital, Stapleton, N. Y., 1926-27; United States Marine Hospital, New Orleans, La., 1927-29; United States Marine Hospital, San Francisco, 1929-30; assistant, orthopedic surgery; Stanford University, 1932-35; University of California Medical

School, 1935-; private practice, orthopedic surgery, San Francisco, 1930-; associate, orthopedic surgery; Mary's Help Hospital; French Hospital, San Francisco. Fellow: American College of Surgeons; American Medical Association; member: Western Orthopedic Association; California Medical Association; San Francisco County Medical Association.

Pattison, Donald H., Lieutenant (MC) USNR (*Posterior Gonococcal Urethritis*, p. 278). B. A., University of Wisconsin, 1930; M. D., University of Wisconsin Medical School, 1936; M. S. (urology), University of Minnesota Medical School, 1942. Resident, Philadelphia General Hospital, 1936-38; fellow in urology Mayo Foundation for Medical Education and Research, 1938-42; first assistant, department of urology, Mayo Clinic, April-June 1942. Member: Olmsted-Houston-Fillmore-Dodge Counties Medical Society; Minnesota State Medical Association.

Rosenberg, David H., Lieutenant Commander (MC) USNR (*Treatment of Cerebrospinal Fever with Penicillin*, p. 281). B. S., Washington and Jefferson College, 1924; M. D., Johns Hopkins University School of Medicine, 1928. Intern, Michael Reese Hospital, Chicago, 1928-30; clinical assistant in medicine, 1931-34, instructor in medicine, 1934-41, and associate in medicine, 1941-, Northwestern University Medical School; associate attending physician, Cook County Hospital, Chicago, 1932-36; adjunct attending physician, 1932-33, and senior adjunct attending physician, 1933-, Michael Reese Hospital; clinic assistant, 1930-32, clinic physician, 1932-, and chief of section in medicine, Mandel Clinic, Michael Reese Hospital. Fellow American Medical Association; member: American Gastro-Enterological Association; Central Society for Clinical Research; American Society for Clinical Investigation; Chicago Medical Society; Illinois State Medical Society; American Gastroscopic Club; American Federation for Clinical Research; Chicago Society of Internal Medicine; Diplomate American Board of Internal Medicine.

Ruzicka, Edwin R., Lieutenant (MC) USNR (*Endotracheal Anesthesia for Dental and Oral Surgery*, p. 304). B. S., University of Maryland, 1936; M. D., University of Maryland School of Medicine and College of Physicians and Surgeons, 1939. Intern, University Hospital, Baltimore, Md., 1939-41; fellow, anesthesia, Lahey Clinic, Boston, 1941-42. Junior member American Society of Anesthetists.

Sayer, Arthur, Lieutenant Commander (MC) USNR (*Blastomycosis of the Skin (Gilchrist Type) with Associated Blastomycetic Pulmonary Disease*, p. 333). B. S., College of the City of New York, 1913; M. D., Columbia University College of Physicians and Surgeons, 1919. Private practice, New York City, 1920-; chief of clinic and assistant dermatologist, Mt. Sinai Hospital, New York City, 1920-42; attending dermatologist and syphilologist (on leave of absence), Morrisania City Hospital, New York City. Fellow American Medical Association; member: American Academy of Dermatology and Syphilology; Bronx Dermatological Society. Diplomate American Board of Dermatology and Syphilology.

Schneierson, Sol S., Lieutenant Commander (MC) USNR (*Sulfonamide Ointment in Routine Prophylaxis of Chancroid Disease*, p. 391). A. B., Cornell University, 1928; M. D., Long Island College of Medicine, 1932. Intern, Metropolitan Hospital, Welfare Island, N. Y., 1932-33; research assistant, Pasteur Institute, Paris, 1938-39; London School of Hygiene and Tropical Medicine, 1939; private practice, New York, N. Y., 1933; assistant bacteriologist and senior clinical assistant physician, Mt. Sinai Hospital, New York City.

Associate American College of Physicians; member: American Medical Association; Society of American Bacteriologists; American Society of Tropical Medicine.

Schwab, William J., Lieutenant Commander (MC) USNR (*Simple Treatment for Hemorrhage into the Nail Bed*, p. 371). Providence College, 1929; M. D., Georgetown University School of Medicine, 1933. Intern, St. Joseph's Hospital, Providence, R. I., 1933-34; surgical resident, St. Francis' Hospital, New York City, 1935-36; visiting surgeon, out-patient department, and assistant secretary, tumor clinic, St. Joseph's Hospital, Providence, R. I., 1937-40; visiting gynecologist, House of the Good Shepherd, Providence, R. I., 1937-40. Member Providence Medical Association.

Scott, Wendell G., Commander (MC) USNR (*Low Back Pain: Subluxations of Apophyseal Joints and Fractures of Articular Facets*, p. 234). M. D., Washington University School of Medicine (St. Louis), 1932. Intern, Barnes Hospital, 1933-34; instructor, radiology, Washington University, 1934-38; assistant radiologist: Barnes Hospital, St. Louis; Edward Mallinckrodt Institute of Radiology; St. Louis Children's Hospital; assistant professor, clinical radiology, Washington University. Fellow American Medical Association; member: American College of Radiology; Radiological Society of North America; Southern Medical Association; American Roentgen Ray Society; St. Louis Medical Society. Diplomate American Board of Radiology.

Steiner, Morris, Lieutenant Commander (MC) USNR (*Traumatic Rupture of the Spleen*, p. 216). M. D., New York University School of Medicine, 1928. Intern and assistant resident pediatrician, 1928-31, adjunct pediatrician and member of Pediatric Research Laboratory, Jewish Hospital, Brooklyn, N. Y. Fellow American Medical Association; member: American Association for the Advancement of Science; American Trudeau Society; American Academy of Pediatrics; Brooklyn Academy of Pediatrics; Kings County Medical Society; New York State Medical Society. Diplomate American Board of Pediatrics.

Vaughan, Homer C., Jr., Lieutenant (DC) USNR (*Processing Acrylic Dentures*, p. 297). D. D. S., New York University College of Dentistry, 1931. Clinical instructor in prosthetic dentistry, 1931-37. Recipient of the Morris L. Chaim award for original research, 1943. Fellow New York Academy of Dentistry; member: American Dental Association; First District Dental Society; American Full Denture Society.

Waterman, Julius L., Captain (MC) USNR (*Polycystic Disease of the Kidneys*, p. 223). M. D., Cornell University Medical School, 1911. Intern, Bellevue Hospital, New York City, 1912-13; attending urologist: Highland Hospital, Park Avenue Hospital, and Monroe County Hospital, Rochester, N. Y., 1921-30; chief clinician, Pennsylvania State Venereal Clinic, Bradford, Pa., 1930-; consulting urologist: Community Hospital, Kane, Pa., 1931; Warren General Hospital, Warren, Pa., 1932; Warren State Hospital, Warren, 1932-; urologist-in-chief, Bradford Hospital, Bradford, Pa., 1931-. Fellow: American College of Surgeons; American Medical Association; member: American Urological Association; Central Section American Urological Association; Western New York and Ontario Branch of American Urological Association; American Neisserian Medical Association; McKean County (Pa.) Medical Society (president, 1938); Medical Society of the State of Pennsylvania. Diplomate American Board of Urology.

Wheeler, J. Arthur, Jr., Lieutenant, junior grade D-V(S) USNR (*A Psychometric Procedure for Screening Mental Defectives*, p. 316). A. B., Harvard College, 1928; Ed. M., Harvard University, 1933. Psychologist, G. S. E. Psycho-Educational Clinic, Cambridge, Mass., 1930-33; instructor, Chicago Teachers

- College, 1933-34; Dean, Eaglebrook School, 1937-41; instructor, Smith College, 1941-42. Member American Association for the Advancement of Science.
- White, Frank S.**, Lieutenant (MC) USNR (*Case of Sulfonamide Reaction*, p. 355). B. S., Shurtleff College, Alton, Ill., 1927; M. D., Washington University School of Medicine (St. Louis), 1932. Intern: Indianapolis City Hospital, Indianapolis, Ind., 1932-33; Bellevue Hospital, pediatric dept., New York City, 1933-34; private practice, pediatrics, 1934-; associate pediatrician, Vanderbilt Clinic (Medical Center), New York City, 1935-; associate chief of pediatrics, Holy Name Hospital, Teaneck, N. J., 1939-. Member: Medical Society of New Jersey; Bergen County Medical Society. Diplomate American Board of Pediatrics.
- Williams, James N.**, Commander (MC) USNR (*Analysis of Psychiatric Patients Transferred to the United States from an Overseas Base*, p. 311). M. D., Medical College of Virginia, 1930. Intern: Sheltering Arms Hospital, Richmond, Va.; St. Luke's Hospital, Richmond; staff member, Southwestern State Hospital, Marion, Va., 1936; private practice, Richmond, 1932-41; director, State Bureau of Mental Hygiene, 1935-40; associate in neuropsychiatry, Medical College of Virginia, 1937-; assistant neurologist, Medical College of Virginia, Hospital Division; associate in neuropsychiatry, University of Virginia Department of Medicine; Psychiatric Institute, N. Y., 1940. Fellow: American College of Physicians; American Medical Association; member: American Psychiatric Association; Southern Medical Association; Medical Society of Virginia; Virginia Neuropsychiatric Society; Richmond Academy of Medicine; Royal Medico Psychological Association. Diplomate American Board of Psychiatry and Neurology.
- Williams, Stanley B.**, Lieutenant, junior grade H-V(S) USNR (*A Psychometric Procedure for Screening Mental Defectives*, p. 316). B. A., 1934, M. A., 1937. University of California at Los Angeles; Ph. D., Yale University, 1940. Instructor, psychology: University of Maine, 1940-42; Brown University, 1942-43. Associate American Psychological Association.
- Witwer, Russell G.**, Lieutenant Commander (MC) USNR (*A Flying Suit to Aid in the Control of Hemorrhage*, p. 366). M. D., Hahnemann Medical College and Hospital of Philadelphia, 1935. Intern, Huron Road Hospital, East Cleveland, Ohio, July 1935-36; staff member: Huron Road Hospital, 4 years; Grace Hospital, Cleveland. Fellow American Medical Association; member: Cleveland Academy of Medicine; Cleveland Homeopathic Medical Society; Ohio State Medical Association.
- Yarrington, Charles T.**, Lieutenant (MC) USNR (*Case of Sulfonamide Reaction*, p. 355). M. D., Hahnemann Medical College and Hospital of Philadelphia, 1931. Intern, Robert Packer Hospital, Sayre, Pa., 1931-32; general practice, Moravia, N. Y., 1932-42; staff member: Auburn City Hospital; Mercy Hospital, 1932-, Auburn, N. Y. Fellow American Medical Association; member: Medical Society of the State of New York; Cayuga County Medical Society; Association of American Physicians and Surgeons.
- Zeve, Herman S.**, Commander (MC) USNR (*Sulfonamide Ointment in Routine Prophylaxis of Chancroid Disease*, p. 391). M. D., Jefferson Medical College of Philadelphia, 1922. Intern, Philadelphia General Hospital, 1922-24; private practice, Youngstown, Ohio, 1924-42; associate urologist, Youngstown Hospital; consultant, Youngstown Venereal Clinic; urologist, Mahoning Tuberculosis Hospital, Youngstown. Fellow American Medical Association; member Cleveland Urological Society.



UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 43

NUMBER 3



SEPTEMBER 1944

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

The dispassionate character of medicine is exemplified by this picture taken somewhere in France. After binding the wounds of friend and foe, Lieutenant, junior grade, Donald C. Phillips (MC) U.S.N.R., of Oak Park, Illinois, listens to a United States Marine and a captured German soldier as they tell what happened.

—Official U. S. Navy Photo.

VOL. 43

SEPTEMBER 1944

NO. 3

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1945,
Public Law No. 347, approved June 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

See page II for prices

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

	PAGE
PREFACE	III
NOTICE TO CONTRIBUTORS	IV
SPECIAL ARTICLES	
Cultivation of the Gonococcus; Advantages of Chocolate Agar with Bacto-Supplement-A as Culture Medium—Harry E. Morton and Paul R. Leberman	409
Choline Hydrochloride in Experimental Yellow Fever in Rhesus Monkeys—A. W. Sellards and William S. McCann	420
Penicillin in Sulfonamide-Resistant Gonorrhea; Preliminary Report of 124 Cases—John G. Menville and Clarence W. Ross	423
Modified Intensive Method for Treatment of Primary and Secondary Syphilis—Herman S. Zeve	429
Evaluation of the Cold Agglutination Test in Primary Atypical Pneumonia—John H. L. Heintzelman and Arthur W. Seligmann, Jr	433
Lobar, Broncho-, and Atypical Pneumonia; A Study of 500 Cases—Albert W. Hobby	438
Gastric Diseases in Navy Personnel; A Study of 191 Gastroscopic Examinations—Ralph H. Loe and Edmund H. Berger	450
Effective Management of Gastro-Intestinal Department at Naval Hospitals—Henry A. Monat and William T. Carleton	459
Passage of Miller-Abbott Tube Through Pylorus with Aid of Electromagnet—Henry Mayer, Jr	463
Fractures of the Carpal Navicular—Herbert E. Hipps	467
Skeletal Traction in Fractures of Hand and Wrist—Walter W. Ebeling ..	477
Hidden Dementia Praecox—Joel M. Hill and Harold M. Hildreth	483
Invalidings From the Service for Causes Existing Prior to Enlistment; Women's Reserves—Herbert A. Raskin	490
Maxillofacial Kodachrome Photography—John W. Richter	495

	Page
Thermal Stimuli in Operative Dentistry; Control of Pain—Milton B. Engel	502
Pain Relief—Alfred M. Rochester.....	504
Dental Department on a Troop Evacuation Ship—Albert B. Larson....	507
Eighteen Months on an Attack Transport—Harry D. Vickers.....	513
Management of Fungus Infection of the Feet—Frank Glauser.....	525

CLINICAL NOTES

Amebiasis as Cause of Recurrent Abdominal Pain; Report of Cases—Leon J. Taubenhaus.....	527
Gonorrheal Ophthalmia; Report of Two Cases of Unusual Origin—Stirling S. McNair.....	532
Early Ophthalmic Findings in a Case of Spontaneous Subarachnoid Hemorrhage of Brain—Karl B. Benkwith.....	535
Air Embolism in a Diver; Report of Fatal Case—Frank J. Gouze.....	538
Parafrenal Abscess; Complication of Gonorrheal Urethritis—Ben Klotz	543
Severe Iridocyclitis Treated with Penicillin—Clyde E. Harner and Joseph G. Smith.....	546
Waterhouse-Friderichsen Syndrome; Report of a Case—Milton B. Filberbaum	549
Sodium Fluoride Poisoning—Oscar Greene.....	551

MEDICAL AND SURGICAL DEVICES

Mobile Surgery Unit for Amphibious Operations—Frank S. Ashburn...	552
Debridement Unit—Charles E. Baldree, Jr.....	555
A Time-Saving Combination Sling—Francis C. Lutz and Harold Y. D. Bonsole	557
Exercising Device for Increasing Joint Action—Louis B. Newman.....	559
Emergency Surgical Spotlight—Markley C. Cameron.....	562
Quick-Filling Irrigating Syringe—Truman O. Anderson.....	563
Dental Chair as Auxiliary Operating Table—Henry H. Hall.....	565
Toothbrush Bracket—Merritte M. Maxwell.....	567

EDITORIALS

The Postcholecystectomy Syndrome.....	568
Gas Gangrene	569

TABLE OF CONTENTS

VII

BOOK NOTICES

	Page
Principles and Practice of Aviation Medicine, <i>Armstrong</i>—Backache and Sciatic Neuritis, <i>Lewin</i>—Minor Surgery, <i>Christopher</i>—Traumatic Injuries of Facial Bones, <i>Erich and Austin</i>—Gastro-Enterology, <i>Bockus and colleagues</i>—Office Treatment of the Nose, Throat and Ear, <i>Hollender</i>—Essentials of Dermatology, <i>Tobias</i>—Pathology and Therapy of Rheumatic Fever, <i>Lichtwitz</i>; edited by <i>Chester</i>—Fighting Fitness, <i>Crampton</i>—Foote's State Board Questions and Answers for Nurses, compiled by 11 authorities on nursing education.....	572

PREVENTIVE MEDICINE

Investigation of a Jaundice Epidemic in Tunisia; Preliminary Report—<i>Horace M. Gezon</i>.....	579
Hazards of Carbon Tetrachloride in Present-Day Use—<i>Samuel R. Sherman and Clifford F. Binder</i>.....	590
A Campaign Against "Athlete's Foot"—<i>Jack L. Derzavis and John R. Poppen</i>	600
NOTES ON OUR RESERVE CONTRIBUTORS.....	603

U. S. NAVAL MEDICAL BULLETIN

VOL. 43

SEPTEMBER 1944

No. 3

SPECIAL ARTICLES

CULTIVATION OF THE GONOCOCCUS

ADVANTAGES OF CHOCOLATE AGAR
WITH BACTO-SUPPLEMENT-A
AS CULTURE MEDIUM

HARRY E. MORTON, Sc.D.¹

and

PAUL R. LEBERMAN

Lieutenant Commander (MC) U.S.N.R.

The diagnosis of gonorrhea is either made or confirmed in the laboratory. In the acute stage, the microscopic examination of a gram-stained smear may suffice. However, in chronic cases, in the detection of carriers, in females, when testing for cures, or when there may be legal aspects to the case, the culture method is necessary for an accurate diagnosis. Satisfactory results may be obtained in the culture method for detecting gonococci if the following procedures are employed:

1. A satisfactory representative sample of the exudate or other material to be examined for gonococci is obtained.

2. If the specimen cannot be cultured immediately it must be preserved in a suitable manner, such as suspending it in a 2-percent solution of Bacto-Proteose Peptone No. 3 in 0.5-percent sodium chloride. This precaution will give satisfactory results if the interval between collecting the specimen and culturing is no longer than 8 hours and the material is stored in the refrigerator.

3. The culture medium must grow gonococci even though only a few microorganisms are deposited upon it. Not only must the medium adequately support growth of gonococci, but its surface must be moist; that is, it must be freshly prepared. However the surface should be free from excess water of condensation.

¹Associate Professor in Bacteriology, School of Medicine, University of Pennsylvania.

4. The cultures are incubated in an atmosphere containing added carbon dioxide. This may be accomplished in a number of practical ways, such as by partially emptying jars containing the cultures and allowing carbon dioxide to enter from a cylinder, by placing the cultures and a lighted candle in a jar with a tight fitting lid, or by placing moistened oats in the jar (a handful of moistened oats per quart capacity of the jar).

5. The cultures should be incubated for from 24 to 48 hours at a temperature not greater than 37° C., preferably about 36° C.

The culture medium perhaps is the most variable of the factors cited. The medium which is as satisfactory as any and easiest to make is the chocolate agar (1) prepared from dehydrated ingredients.² The colonies of the gonococcus are relatively small even on a satisfactory medium. Any modification of a medium which would result in gonococcal colonies of a larger size would be an important improvement. Contaminants, such as staphylococci and diphtheroids, which are almost always present in gonococcal pus from the male urethra, frequently overgrow the gonococci and make isolation of the latter almost impossible. It is highly desirable to employ a dye with a selective bacteriostatic action, permitting growth of gonococci and at the same time preventing to a large extent the growth of the gram-positive contaminants. Crystal violet in suitable concentration has this property.

Lankford, Scott, Cox, and Cooke (2) report that over a period of a few months 10 to 15 percent of the strains of gonococci encountered produced such small colonies on the usual medium as to be barely visible even when employing the oxidase test. These strains would not grow on autoclaved medium except in the presence of certain other bacteria or with the addition of fresh extracts of liver, yeast, or blood or similar substances.

The addition of extractives from yeast with crystal violet, as proposed by the Difco Laboratories as Bacto-Supplement-A, would appear to have a twofold effect in facilitating the isolation of the gonococcus from clinical material. The extractives of yeast should enhance the growth of the more fastidious strains of the gonococcus, and the crystal violet should suppress the growth of the gram-positive contaminants. Both factors are highly desirable.

Because of the great importance of a practical and reliable method for isolating the gonococcus, a study was made comparing the standard chocolate agar and the chocolate agar with Bacto-Supplement-A (extractives of yeast and crystal violet).

² Bacto-Proteose No. 3 agar enriched with Bacto-Hemoglobin. Difco Laboratories, Detroit, Mich.

MATERIALS AND METHOD

Sterile swabs were prepared by tightly twisting a small piece of cotton on the end of an applicator stick. The swabs should not be large, otherwise they will absorb too much of the Proteose Peptone No. 3 solution in the tubes. Several swabs were placed in a tube, and the tube was plugged with cotton and sterilized in the hot air sterilizer at 175° C. for 45 minutes.

The solution was prepared by dissolving 2 gm. of Bacto-Proteose Peptone No. 3 and 0.5 gm. of sodium chloride in each 100 ml. of distilled water. Usually 100 ml. amounts of such a solution were dispensed into 4-ounce bottles with screw caps and sterilized in the autoclave at 121° C. for 20 minutes. Prior to use 1 ml. of the sterile Proteose Peptone No. 3 solution was dispensed into each of the several sterile test tubes plugged with cotton.

Proteose No. 3 agar was prepared by dissolving 9 gm. of Bacto-Proteose No. 3 agar, dehydrated, in each 100 ml. of distilled water, heating to boiling to insure complete solution. Usually 100-ml. amounts were dispensed into 8-ounce bottles with screw caps and sterilized in the autoclave at 121° C. for 20 minutes.

Hemoglobin solution was prepared by dissolving 2 gm. of Bacto-Hemoglobin, dehydrated, in each 100 ml. of cold distilled water, shaking thoroughly, heating to boiling and straining through gauze to remove undissolved particles. Usually 100 ml. amounts were dispensed into 4-ounce bottles with screw caps and sterilized in the autoclave at 121° C. for 20 minutes.

Four- and eight-ounce bottles with screw caps were used for storing culture medium, if it was not going to be used immediately. The screw caps prevent loss by evaporation and contamination if the bottles happen to tip over. If the culture medium is to be used within a relatively short period of time, 4- and 8-ounce nursing bottles are used because they are more economical than flasks and require a minimum of space in the refrigerator. If large numbers of culture plates are needed at one time, the large quantities of medium are prepared in flasks, and plates are prepared before the medium solidifies after being autoclaved.

To prepare culture plates, the Proteose No. 3 agar is cooled to about 50° C. in a water bath after being removed from the autoclave, or bottles of the Proteose No. 3 agar are heated in boiling water until the agar is melted, then cooled to about 50° C. Corresponding quantities of the 2-percent hemoglobin solution are heated to 50° C. and the solutions are mixed and poured into sterile Petri dishes. By placing equal volumes of each solution in large bottles the contents of one may be poured into the other and the

solution mixed merely by rotating the bottle. Each 200 ml. of the hemoglobin-Proteose No. 3 agar (hereafter referred to as chocolate agar) is sufficient for 13 or 14 plates.

The enriched chocolate agar with crystal violet was prepared by adding 2 ml. of Bacto-Supplement-A to each 200 ml. of chocolate agar at 50° C. before pouring it onto Petro dishes. The addition of Bacto-Supplement-A provides extractives of yeast in a final concentration of 1 percent and crystal violet in a final concentration of 1:600,000. In this concentration in this medium, crystal violet permits the growth of gram-negative microorganisms, including the gonococcus, but inhibits to a great extent the growth of gram-positive microorganisms, including the staphylococci and diphtheroids which are so commonly present in material being cultured for the gonococcus. The extractives of yeast should make possible the growth of the more fastidious strains of gonococci.

Culture plates were used within 24 hours after their preparation, as freshly prepared plates provide optimum conditions for growth of gonococci.

For performing the oxidase test a freshly prepared 1-percent aqueous solution of dimethyl-p-phenylene diamine hydrochloride was used.

Fermentation tests were employed to verify as *Neisseria gonorrhoeae*, gram-negative diplococci which gave a positive oxidase test. The medium employed for these tests was prepared by dissolving 1.6 gm. of Bacto-Phenol Red Broth Base, dehydrated, in each 100 ml. of distilled water and adding 0.1 gm. of agar, because the gonococcus grows best in a medium which is semi-solid in consistency. To a 100-ml. portion of this medium was added 1 gm. of glucose or maltose, and the medium was then dispensed into test tubes (150 by 16 mm.) in approximately 5-ml. amounts, and sterilized in the autoclave at 121° C. for 15 minutes.

EXPERIMENTS

A drop of exudate was collected on a sterile swab by stripping the urethra. The swab and exudate were placed immediately in a tube containing 1 ml. of Proteose Peptone No. 3 solution and transported to the laboratory. Within one to four hours the exudate was suspended thoroughly in the peptone solution by twirling the swab in the liquid and pressing against the inside of the tube to express as much of the liquid as possible from the swab. The swab was discarded and the material cultured by streaking onto culture plates. A loopful of each specimen in the peptone solution was streaked over the surface of a chocolate agar plate (fig. 1). Another loopful of each specimen was streaked in a similar manner over the surface

of a plate of chocolate agar containing Bacto-Supplement-A. In a few instances another loopful of the specimen was streaked over the surface of a plate of Peizer's medium (4). In other cases additional plates of each medium were streaked and incubated under different conditions.

The pairs of streaked plates were placed in glass museum jars fitted with metal lids and a pet cock, the air was withdrawn to 150 mm. of mercury below atmosphere pressure, and carbon dioxide was allowed to enter the jars from a cylinder until the negative pressure was decreased by at least 76 mm. The cylinder was then disconnected and air was permitted to flush the carbon dioxide in the hose connection into the jars, thus reestablishing atmospheric pressure. The pet cock on the jars was closed and the jars were placed in the incubator at 36° to 37° C. for approximately 48 hours. The carbon dioxide content in several jars was measured after the incubation period and found to range from 5 to 7 percent. A few duplicate plates were incubated as controls in similar jars without the addition of carbon dioxide.

Some strains of the gonococcus did not grow in the absence of added carbon dioxide; no strains were encountered which failed to grow in the presence of the added carbon dioxide. This confirmed the findings of numerous other investigators; namely, that for the isolation of gonococci from patients, the primary cultures must be incubated in an atmosphere of added carbon dioxide. A few duplicate sets of cultures were incubated in closed jars containing a handful of moistened oats per quart capacity of the jars; other duplicate sets of cultures were incubated in closed jars in which a lighted candle was placed. The three methods for supplying carbon dioxide produced abundant growth of colonies of gonococci.

The plates were removed from the jars after approximately 48 hours and examined for typical colonies. These were tested with a loopful of the oxidase reagent and observed for characteristic changes in color. Smears were made from similar colonies and stained by the Gram technic, Hucker's modification. If gram-negative diplococci gave a positive oxidase reaction, the same or similar colonies were subcultured into two tubes of semisolid phenol red agar medium, as described, containing glucose and maltose respectively. The fermentation tubes were placed in a jar with a tight fitting lid. Carbon dioxide was not added to the jar because the gas is absorbed by the culture medium and the increased acidity is sufficient to cause the phenol red indicator to change color. Growth was obtained more consistently when the fermentation tubes were placed in a jar with a lid before being placed in the incubator, prob-

ably because proper moisture and gaseous environment is thus assured. If only a few fermentation tubes are used, an alternate technic is to push the cotton plugs into the culture tubes and close the tubes with rubber stoppers.

By transferring only those colonies of gonococci which were well isolated on the original plate, contaminations in the fermentation tubes were seldom encountered. However, if gonococcal colonies are transferred from an area on the original plate where the inoculum was heavy, contaminants may be encountered because crystal violet in the concentration employed only suppresses growth of gram-positive organisms and does not kill them (bacteriostasis). In some cases it may be desirable or necessary to streak a gonococcal colony on a second enriched chocolate agar plate in order to insure pure colonies for transferring to fermentation tubes.

Those plates which showed no colonies suspected as being *N. gonorrhoeae* were flooded with a few tenths of a milliliter of the oxidase reagent and observed for typical color changes. In this series of cultures no oxidase negative strains of gonococci were observed, although such strains do occur (3).

Although the streaking of culture plates is a fundamental technic in bacteriology, it often is neglected. Failure to acquire a satisfactory streaking technic so as to get consistently well isolated colonies often leads to disappointing results. This is particularly true when glass-top Petri plates are used with freshly prepared media, as the water of condensation may cause the inoculum to spread.

The technic whereby a drop or a loopful of the specimen is deposited in the center of a culture plate and then smeared over the entire surface of the medium with a sterile bent glass rod did not give satisfactory results. Even though the colonies were isolated they were not as large as on the plates streaked by the method to be described. Perhaps there are too many organisms competing for nourishment in the medium, and as a result of the growth of numerous colonies none attains as large a size as when there are fewer colonies on the surface of the medium. The use of porous Petri dish tops is a great asset when working with a medium the surface of which is excessively moist.

A technic for streaking culture plates which has given very good results over a period of years in the hands of students seems worthy of description in detail.

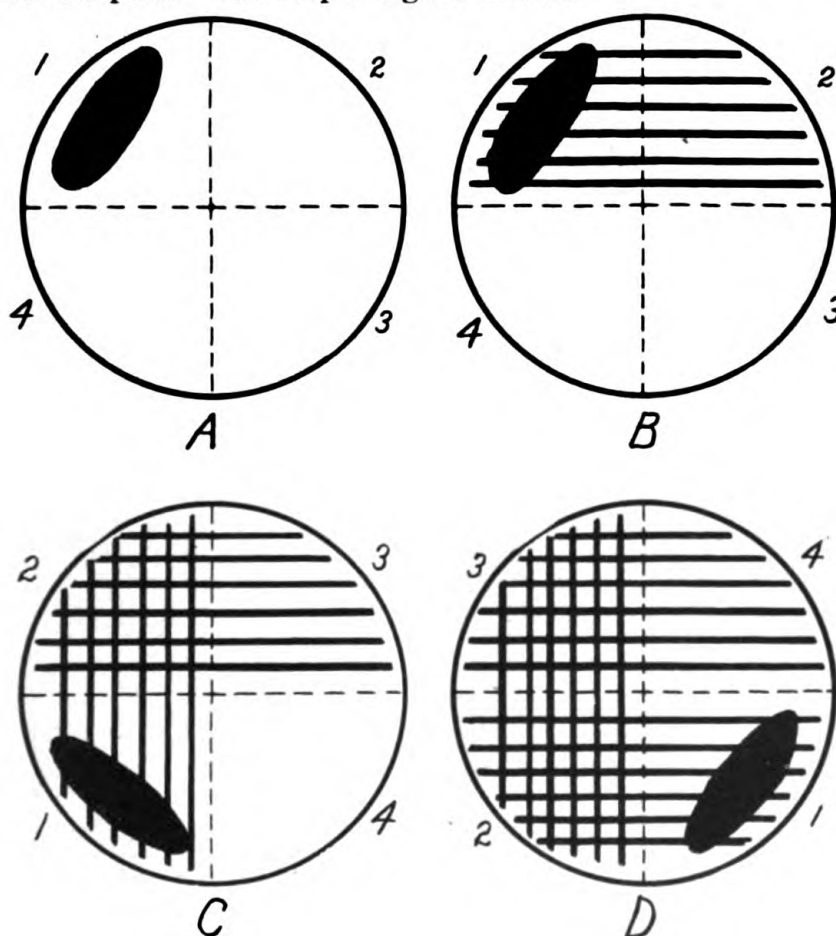
The agar plate is divided into imaginary fourths as indicated by the broken lines in figure 1.

1. A loopful of the specimen is streaked in the upper left quadrant as indicated and the loop is flamed.

2. With the sterile loop the inoculum originally deposited in the left quadrant of the plate is streaked over one-half the surface by a series of parallel lines, usually about six. Streaking should be done across the surface of the medium from left to right and from the edge toward the center of the plate. The loop is then flamed.

3. The plate is given a quarter turn as indicated and with the sterile loop the inoculum in the second quadrant is streaked over one-half the plate as was done in the first quadrant, and the loop is again flamed.

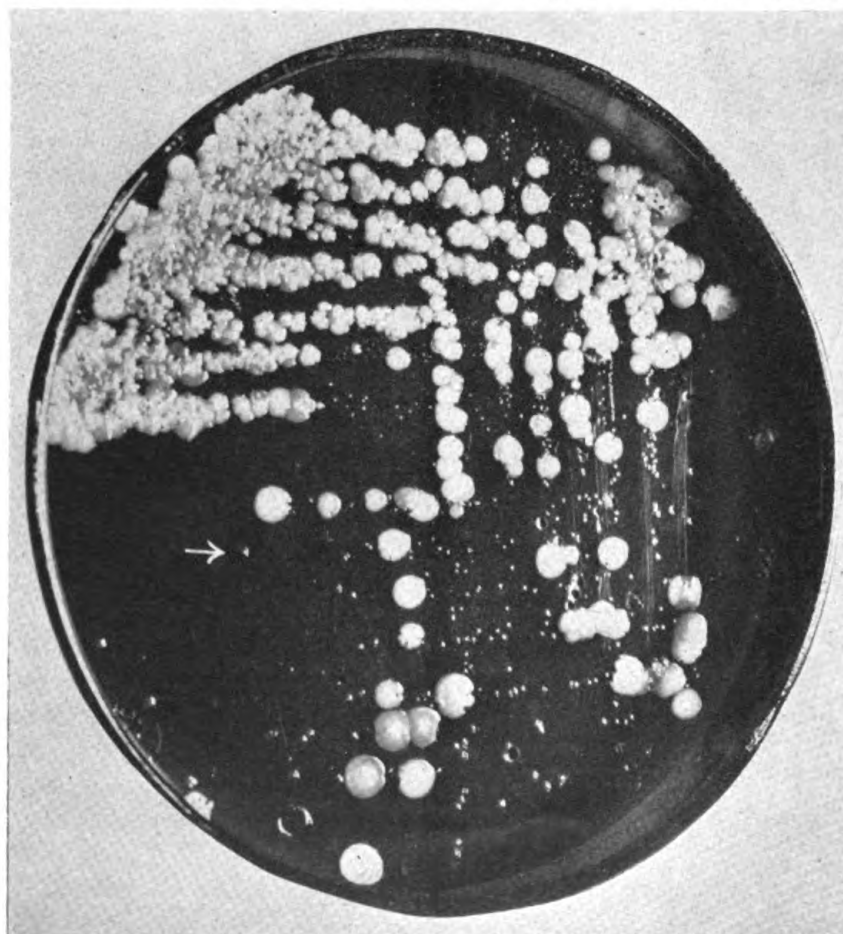
4. Again the plate is given a quarter turn as indicated and with the sterile loop the inoculum in the third quadrant is streaked over one-half the plate. The loop is again flamed.



1. A method for streaking culture plates. See text.

With specimens containing only a few microorganisms, isolated colonies will develop in the first or second quadrants of the plate, whereas with those specimens heavily infected, the isolated colonies will appear in the third or fourth quadrants. Typical results obtained by this method of streaking are shown in figures 2 and 3. In those specimens which are free of gonococci or where the gonococci

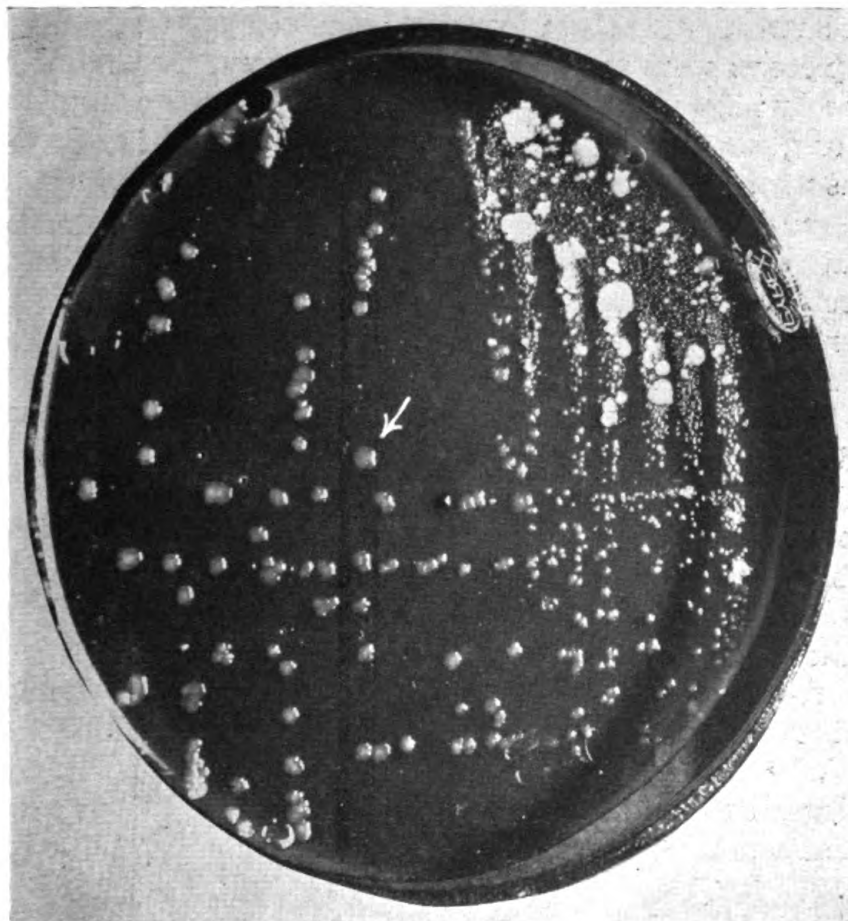
are very sparse, such as tests for cures, an original inoculum of more than one loopful is desirable and may be used with safety. A drop or a few tenths of a milliliter may be deposited on the surface of the chocolate agar plate containing Bacto-Supplement-A because the crystal violet retards the growth of the gram-positive organisms and the plates are not ruined by the heavy growth of contaminants. When several plates are to be streaked at one time it is advantageous to use two loops. By allowing one loop to cool while the other is being used there is less danger of destroying the organisms in the inoculum with a hot loop. It also saves time.



2. Primary culture on chocolate agar after approximately 48 hours' incubation in the presence of 5- to 7-percent carbon dioxide. The culture plate was photographed at an angle so as to photograph the colonies by reflected light. Numerous large colonies of staphylococci and diphtheroids can be seen, and several isolated gonococcal colonies about 1 mm. in diameter. A gonococcal colony is indicated by the arrow.

RESULTS

The number of patients cultured was 65, the number of cultures made in duplicate 104. Seventy-eight cultures were found positive on both chocolate agar and chocolate agar containing Bacto-Sup-



3. Primary culture on chocolate agar containing Bacto-Supplement-A. Conditions of inoculation, incubation, etc. were the same as for the culture shown in figure 2. There are very few contaminating colonies of staphylococci and diphtheroids. The gonococcal colonies are more numerous and larger, some being 3 mm. in diameter. A gonococcal colony is indicated by the arrow.

plement-A. Eighteen cultures were negative on both chocolate agar and chocolate agar containing Bacto-Supplement-A. Eight cultures were found negative on chocolate agar and positive on chocolate agar containing Bacto-Supplement-A. None was found positive on chocolate agar and negative on chocolate agar containing Bacto-Supplement-A.

COMMENT

Although there were 78 duplicate sets of clinical cultures in which the gonococcus grew on both the chocolate agar with Bacto-Supplement-A and the unsupplemented chocolate agar, many of the cultures on the unsupplemented chocolate agar were so heavily overgrown with contaminating microorganisms that isolation of the gonococcus would have been difficult if not impossible. The fig-

ures indicate that oxidase positive colonies composed of gram-negative diplococci were present on both media, and the colonies from the chocolate agar with Bacto-Supplement-A were shown to be composed of gonococci by fermentation tests. The total of 8 cultures from as many patients represents the cultures which were positive on the enriched chocolate agar and negative on unsupplemented chocolate agar by the above method of testing. If isolation of the gonococcus from cultures growing on chocolate agar without Bacto-Supplement-A had been attempted, the number of failures would have been much greater.

The greater number of positive cultures on the chocolate agar with Bacto-Supplement-A is due to at least two things. First, the crystal violet retards the growth of contaminating gram-positive microorganisms and thus allows gonococci, if present, to grow undisturbed. Not having to share the nutrient with numerous other colonies, the gonococcal colonies are able to develop to a larger size. Also, the gonococcal colonies are not hemmed in or covered over by the more rapidly growing and larger colonies of contaminants. Second, the extractives of yeast enhance the growth of the gonococci. With some strains of gonococci, this added enrichment to the culture medium is a necessity. In those cases in which the enrichment is not necessary for growth the colonies are 1.5 to 5 times larger.

In three of the eight patients whose specimens were positive only on the chocolate agar with Bacto-Supplement-A, only one specimen was obtained for culturing. In three others of the eight patients a specimen was positive for the gonococcus on both types of medium and was followed in one or two weeks by a specimen which was positive on only the chocolate agar with Bacto-Supplement-A. A specimen from each of the remaining two of the eight patients was positive on only the enriched medium on one occasion, and specimens collected a week later were positive on both media.

Instances were observed of gonococci cultured from the anterior male urethra when no gonococci could be demonstrated in gram-stained smears. This emphasizes again the importance of cultures in the diagnosis of gonorrhea.

One lot of Peizer's medium was prepared and used with a small number of specimens. The gonococcal colonies were not as large as on the chocolate agar with Bacto-Supplement-A and not as numerous. For those reasons the medium was not employed with a larger number of specimens. A minor criticism of chocolate agar offered by some workers is that it is not transparent. This property of a medium is a personal preference and is not so important if the

chocolate agar contains Bacto-Supplement-A, because the gonococcal colonies are larger than on the ordinary chocolate agar and are more easily seen by the unaided eye (figs. 2 and 3).

SUMMARY

The purpose of the study was to compare the value in diagnosis of chocolate agar, as it is commonly used, with chocolate agar containing Bacto-Supplement-A. The latter medium was found to be more accurate in the detection of gonococci in male urethral discharges.

A practical method for culturing gonococci from material from the anterior urethra of man is described.

REFERENCES

1. Diagnostic Procedures and Reagents. American Public Health Assoc., 1790 Broadway, New York. 1st edition, 1941.
2. LANKFORD, C. E.; SCOTT, V.; COX, M. F.; and COOKE, W. R.: Some aspects of nutritional variation of the gonococcus. J. Bact. 45: 321-327, April 1943.
3. PITTS, A. C.: Laboratory diagnosis of gonococcal infections. Am. J. Syph., Gonorr. & Ven. Dis. 24: 184-200, March 1940.
4. PEIZER, L. R., and STEFFEN, G. I.: Modification of horse plasma hemoglobin agar for primary culture of gonococcus. Usefulness of nile blue A in this medium. Ven. Dis. Inform. 23: 224-226, June, 1942.



SUCCINYL SULFATHIAZOLE AND DIET IN LARGE BOWEL SURGERY

Ingestion of the drug resulted in a dramatic reduction of *B. coli* and *B. aerogenes* in the stool of 36 patients in less than five days, whether or not ulcerative mucosal lesions were present. This reduction occurred without relation to the nature of the diet.—ARCHER, H. L., and LEHMAN, E. P.: Clinical and laboratory experiences with succinyl sulfathiazole. Ann. Surg. 119: 518-524, April 1944.



LOW PROTEIN AND ARSENICAL LIVER DAMAGE

Depletion of body protein stores by means of low protein diet or plasmapheresis causes greater susceptibility to liver injury by the arsenical compound, mapharsen.

Methionine (2 to 4 gm.) given by mouth 20 to 24 hours prior to administration of mapharsen is protective and the dogs will tolerate 0.0045 gm. per kilo with no icterus developing.—GOODELL, J. P. B.; HANSON, P. C.; and HAWKINS, W. B.: Methionine protects against mapharsen liver injury in protein-depleted dogs. J. Exper. Med. 79: 625-632, June 1, 1944.

CHOLINE HYDROCHLORIDE IN EXPERIMENTAL YELLOW FEVER IN RHESUS MONKEYS¹

A. W. SELLARDS, M.D. (Deceased)

and

WILLIAM S. McCANN

Captain (MC) U.S.N.R.

Interest in the effects of choline upon a variety of hepatic disorders was first aroused by the observations made in Toronto by Best in 1932, and was furthered by the studies of Griffith, who showed that hemorrhagic degeneration of liver and kidneys occurred when experimental animals were deprived of choline. A considerable literature which had grown up about this subject was recently reviewed by Griffith² and Best³.

Extensive use was made of choline as a supplement in treating all types of hepatitis and cirrhosis over a period of 18 to 20 months. Though encouraging, these results have not been published because they are extremely difficult to evaluate scientifically inasmuch as, unlike animal experimentation, there are many factors that could not be controlled.

In December 1941 arrangements were made to carry out experiments at Harvard Medical School on monkeys inoculated with a virus of yellow fever. The study was begun and carried on for several months when it was interrupted by the illness and death of Dr. Sellards. This untimely occurrence made it impossible to report the complete protocols of the experiments, but the results observed are so suggestive that it is felt they should not be lost entirely. They are presented briefly in the hope that they will arouse the interest of some worker who is in a position to carry the investigation further.

Yellow fever was induced in rhesus monkeys (*Macaca mulatta*) by a virus which Sellards had brought back from Dakar about fifteen years before. The virus had been kept active by passage through rhesus monkeys at intervals throughout the intervening period and in each instance a fatal infection had been induced.

¹ From the Department of Comparative Pathology and Tropical Medicine, Harvard Medical School, and the Department of Medicine, School of Medicine and Dentistry, University of Rochester.

² GRIFFITH, W. H.: Nutritional importance of choline. *J. Nutrition* 22: 239-253, September 1941.

³ BEST, C. H.: Significance of choline as dietary factor. *Science* 94: 523-527, December 5, 1941.

TABLE 1.—Summary of results

Lot 1					Lot 2				
Choline started about 2 hours prior to injection of virus					Choline started 3 days prior to injection of virus				
Rheus	Choline		No. of days of continuous fever	Result	Rheus	Choline		No. of days of continuous fever	Result
	Mg. per kilo.	No. of days				Mg. per kilo.	No. of days		
482	80	13	6	Recovery	467	80	3*	1	DD—4th day
483	80	12	none	do	468	80	4*	none	Recovery
461	160	12	do	do	469	160	6*†	3	DD—4th day
465	160	4	2	DD—4th day	470	160	4*	2	DD—4th day
464	control	do	2	DD—3rd day	471	control	do	2	DD—4th day
466			3	DD—4th day	472			3	DD—6th day

* Exclusive of 3 preliminary injections.

† Continued for 6 additional days on 80 mg. per kilo.

In the first experiment a passage monkey was inoculated and subsequently died of yellow fever. From this monkey six monkeys were inoculated, of which four were treated with choline hydrochloride given by means of a stomach tube. The choline was administered 2 hours before injection of the virus and was repeated daily during the period until death occurred, or up to 13 days in the case of the survivors. Two of the treated monkeys received a dose of 80 mg. per kilogram, and two received 160 mg. per kilogram. In this experiment three of the four treated monkeys survived; one died on the fourth day. Both control monkeys died on the third and fourth day respectively. The surviving monkeys all gave evidence of being ill, one had fever for 6 days, and two had no fever. It had been Dr. Sellard's plan to test the blood for protective substance, but no record can be found of the results of such tests if they were performed.

In the second experiment a second passage monkey was inoculated with the virus and subsequently died of yellow fever. From this monkey six other monkeys were inoculated. In this group choline was given to four in the same manner as in the preceding experiment, beginning 3 days before the inoculation. Two monkeys were used as controls. Of the four treated monkeys two survived and two died of yellow fever, while both control monkeys died. Both of the survivors were ill with the disease; one had fever for 3 days; one was afebrile. No record of the results of protection tests is to be found. Such data as remain are recorded only in a summary table (table 1) sent to the writer by Dr. Sellards.

SUMMARY

Of fourteen monkeys (*Macaca mulatta*) inoculated with a potent yellow fever virus which in 15 years had exhibited uniform lethal properties, two passage monkeys and four control monkeys died. Eight monkeys received choline hydrochloride by mouth; of these only three died and five survived.

Examination of the livers of the monkeys that died revealed much more disorganization and acute liver destruction in those that had not received choline. In the choline-treated monkeys that died the livers showed some evidence of a reparative process; that is, much less disorganization of the architecture, and more proliferative changes in the periportal spaces.

These experiments are not conclusive, yet they indicate the possibility that the liver may be protected against a potent virus by the oral administration of choline.

PENICILLIN IN SULFONAMIDE-RESISTANT GONORRHEA

PRELIMINARY REPORT OF 124 CASES

JOHN G. MENVILLE

Lieutenant Commander (MC) U.S.N.R.

and

CLARENCE W. ROSS

Captain (MC) U.S.N.

This report comprises a review of 124 cases of gonorrhea which had not responded to sulfonamide therapy. All of the men were hospitalized and had received at least two courses of sulfonamide drugs; approximately one-half of them had received three courses. A course consisted of 4 gm. daily for 5 to 7 days. Sulfathiazole and sulfadiazine were the drugs most commonly used although sulfamerazine was also employed. These patients were treated with the sodium salt of penicillin and apparently cured.

The average age was 21.7 years; of the 124 cases, 118 were white and 6 Negroes.

The diagnosis was established on a basis of a Gram stain of the urethral discharge and a culture of the prostatic secretion on chocolate blood agar.

Complications.—The cases were not all simple, as 31 had complications exclusive of posterior urethritis manifestations. None of these occurred in the Negro patients.

Gonococcus infection of prostate.....	18
Gonococcus infection of epididymis.....	7
Phlebitis of dorsal vein.....	3
Periurethral abscess.....	2
Arthritis	1
Cowperitis	1
Balanitis	1
Intra-urethral verruca acuminata.....	1

In only 3 cases was the complication dual, which was particularly surprising in view of the 7 cases of epididymitis. The apparent incidence of specific infection of the prostate is believed to be lower than the actual rate, since in most instances the prostate was not examined until the patient was being checked for a cure, and frequently after one course of penicillin had been given.

Involvement of the epididymis was noted on the right side in 2 cases, on the left in 3, and bilaterally in 2 cases. It is interesting to note that 2 of the cases of epididymitis developed after 2 or more

courses of penicillin had been given. All of the complications developed during the course of the disease and all cleared up on treatment of the disease with the exception of the verruca which was fulgurated.

Treatment.—In spite of the excellent work done with penicillin (1) (2) (3) (4) our experience has been one of trial and error. In the beginning 160,000 units were given intramuscularly with good results. A variety of doses was given in an effort to ascertain the smallest curative dose. Although 25,000 and 30,000 units proved failures, 3 out of 5 patients were cured with 40,000 units.

Intramuscular injections were used throughout until this route of administration failed to cure a case of acute arthritis developing in a patient with chronic recurrent gonorrheal urethritis. As an initial course this man received 200,000 units intramuscularly followed by a course of 100,000 units intravenously, a third course of 720,000 units intramuscularly and finally a fourth course of 1, 200,000 units was given intravenously. The disease spread during the interval between the first and second courses. The first sign of improvement of joint symptoms occurred after the second day of intravenous medication, and all signs of arthritis disappeared the day before the intravenous medication was completed.

Following this experience intravenous medication was tried on a number of different cases, using varying doses and giving the medication intermittently and fairly rapidly as well as slowly and continuously. The most striking success by the intravenous route was a cure of a specific infection of the urethra by a continuous drip (30 drops per minute) of 25,000 units in 1,000 cc. of isotonic saline solution.

Our efforts in arriving at the most satisfactory dose of penicillin and the effect of these doses on noncomplicated and complicated cases are represented in table 1.

It is noticeable that the increase in the number of cures on the initial course of penicillin is paralleled by the increase in the amount of penicillin. It is true that one case was cured by 25,000 units, but this was unusual, for only 63 percent of the cases treated with 50,000 units were cured with one course. High percentages of cure were noted only when 100,000 units or more were used. While small doses cure in a small percentage of cases, ultimately larger doses are required to obtain cures in the failures resulting from small doses (tables 1 and 2).

Noncomplicated cases.—In noncomplicated cases the intramuscular route is believed to be the route of choice. The dosage now in use is 100,000 units. This is given in 15,000-unit doses every 3

TABLE 1.—*Variation in dosages*

Units	Total cases	Cured by initial course		Cured by subsequent courses	
		Cases	Complicated	Cases	Complicated
25,000 I. V.	4	1	0	3	0
25,000 I. M.	3	0	0	3	0
30,000 I. M.	1	0	0	1	1
40,000 I. M.	5	3	0	2	1
50,000 I. M.	64	40	1	24	10
60,000 I. M.	1	0	0	1	1
100,000 I. M.	18	16	1	2	1
100,000 I. V.	11	9	3	2	1
160,000 I. M.	7	6	4	1	1
165,000 I. M.	1	0	0	1	1
170,000 I. M.	2	2	0	0	0
200,000 I. M.	2	1	0	1	1
200,000 I. V.	2	2	2	0	0
300,000 I. V.	1	1	1	0	0
400,000 I. V.	1	1	0	0	0
600,000 I. V.	1	1	1	0	0

TABLE 2.—*Dosages in complicated cases*

Complications	Total cases	Cured in one course		Cured in multiple courses	
		Cases	Average dose	Cases	Average dose
Gonococcus infection of prostate	18	7	190,000	11	361,360
Gonococcus infection of epididymis	7 $\begin{cases} \text{R-2} \\ \text{L-3} \\ \text{B-2} \end{cases}$	5	285,000	2	1,040,000
Phlebitis of dorsal vein of penis	3	2	150,000	1	160,000
Periurethral abscess	2	0		2	1,555,000
Arthritis	1	0		1	2,220,000
Cowperitis	1	1	100,000	0	
Balanitis	1	0		1	450,000
Verruca acuminata, intra-urethral	1	1	160,000	0	

hours. The intravenous route has been found very efficient and it is believed that a smaller dose is required when this route is used, provided the infusion is slow and continuous.

Complicated cases.—In at least three cases complications from gonorrheal urethritis developed after a patient had received one or more courses of penicillin. This was probably due to insufficient initial dosage, but it was also evidence that penicillin must be used

judiciously to cure gonorrhea. Complicated cases required a larger amount of penicillin to cure than did the simple ones.

Table 2 shows the result of treating complicated cases with initial doses of varying strengths as contrasted with the amount ultimately needed to cure patients not affected by the initial dose. The discrepancy between the two is marked and the difference is believed to be due to the use of too small an initial dose. It must be remembered however that the initial dose used was selected at random and did not necessarily represent the optimum dose. We not only feel that an insufficient initial dose promotes tolerance to the drug, but believe that a larger initial dose will in the future reduce measurably the total dosage required for a cure. For this reason the figures in table 2 may be useful as a guide in estimating doses for treatment of similar complications.

The case of arthritis was not treated by the injection of penicillin into the joints, but this mode of therapy has been carried out in a later case and proved very successful in eliminating all joint symptoms.

Because of early failures we have adopted the intravenous and intramuscular routes of medication in all complicated and resistant cases. After initial failure to cure, we at least double the previous dose. The routine daily dosage in complicated cases is 100,000 units intravenously in 2,000 or 3,000 cc. of isotonic saline as a continuous drip for 24 hours. During this interval 200,000 units are given intramuscularly. This is given in 20,000-unit doses every 3 hours, and the 2 doses which remain are administered the following day. Using the above as a criterion for a day's treatment we now use the following scale for the treatment of certain complications: Prostatitis 1 day, epididymitis 2 days, periurethral abscess 2 to 3 days and arthritis 3 to 5 days. In arthritis, local instillation into the joint is used daily in addition.

Criteria for cure.—Following penicillin treatment a routine daily morning smear was made and the patient was pronounced cured when he had shown 3 consecutive negative urethral smears and 3 consecutive negative prostatic cultures.

Some of these apparently cured patients were not released from the hospital immediately, and surprisingly 10 of this group who were still restricted to the hospital presented a delayed positive smear for gonorrhea. The longest number of consecutive negative smears observed before a delayed positive occurred was six. Even more remarkable was the fact that this incident occurred twice in 4 cases and 3 times in 1 case before more penicillin resulted in an apparent cure. An analysis of the 10 cases revealed the follow-

ing: Six cases presented complications; 7 cases showed delayed positive smears after an initial dose of 50,000 units or less; 2 cases showed delayed positive smears after 2 or more courses of penicillin had been given but whose original dose was 50,000 units or less; and finally 1 case showed a delayed positive smear after an initial dose of 160,000 units.

From these figures it is reasonable to suspect a connection between a delayed positive smear and a small initial dose of penicillin. We believe this connection to exist, but we also believe that there is, in certain cases, a partial immunity to penicillin either in the host or in the strain of gonococcus. It is possible that all three factors may exist in certain cases.

Toxicity.—The following reactions were noted in patients receiving penicillin: Muscle cramps in 3 cases, and 1 case each of urticarial wheals, nausea, headache, chills and fever. They were all transient and of a minor nature.

In 8 cases there was a slight decrease in the red blood cells and hemoglobin. These patients however had received sulfonamide drugs and the changes may have been produced by the latter drugs. Recent reports show that penicillin is nontoxic (5) (6) (7).

SUMMARY

One hundred twenty-four cases of sulfonamide-resistant gonorrhea were apparently cured by penicillin, yet the response to the drug was not uniform, and the treatment had to be individualized by trial and error methods in estimating dosages. Eighty-three responded to single courses of the drug, and 41 to multiple courses. The route of administration and the treatment of noncomplicated and complicated cases are presented.

Penicillin-treated cases which have met the criteria for cure have a tendency to present latent positive smears in a small percentage of cases. For this reason we require 7 consecutive negative urethral smears and 3 consecutive negative prostatic cultures before patients are discharged.

It should be pointed out, however, that the smears and cultures of these cases, in common with all Naval hospitals, were handled by a laboratory in which the change of personnel has been fairly rapid. This is an uncorrectable situation which contains potentiality of error and although our observations were carefully made, we feel that our findings might have been more accurate had they been made by a laboratory with a more permanent and experienced staff.

REFERENCES

1. RAMMELKAMP, C. H., and KEEFER, C. S.: Absorption, excretion and distribution of penicillin. *J. Clin. Investigation* 22: 425-437, May 1943.

2. HERRELL, W. E.; COOK, E. N.; and THOMPSON, L.: Use of penicillin in sulfonamide resistant gonorrheal infections. J.A.M.A. 122: 289-292, May 29, 1943.
3. KEEFER, C. S.; BLAKE, F. J.; MARSHALL, E. K., Jr.; LOCKWOOD, J. S.; and WOOD, W. B., Jr.: Penicillin in treatment of infections. J.A.M.A. 122: 1217-1224, August 28, 1943.
4. MAHONEY, J. F.; FERGUSON, C.; BUCHHOLTZ, M.; and VAN SLYKE, C. J.: Use of penicillin sodium in treatment of sulfonamide resistant gonorrhea. Am. J. Syph., Gonorr. & Ven. Dis. 27: 525, September 1943.
5. DAWSON, M. H., and HOBBY, G. L.: Clinical use of penicillin: observations in 100 cases. J.A.M.A. 124: 611-622, March 4, 1944.
6. HERRELL, W. E.: Clinical use of penicillin, an antibacterial agent of biologic origin. J.A.M.A. 124: 622-627, March 4, 1944.
7. BLOOMFIELD, A. L.; RANZ, L. A.; and KIRBY, W. M. M.: Clinical Use of penicillin. J.A.M.A. 124: 627-632, March 4, 1944.



OBESITY

Obesity is that bodily state in which there is excessive accumulation of fat. Of "all the thousand natural shocks that flesh is heir to" none is more common, or more distressing, or ultimately more serious than its abnormal accumulation. While to the layman corpulence is primarily a cosmetic defect, making its bearer less attractive to his fellows, to the physician it is a symptom which attains the dignity and importance of a disease.—MACBRYDE, C. M.: Obesity. Clinics 2: 1620-1638, April 1944.



CONDITIONS PRODUCING COUGH

The conditions in which cough is a prominent symptom may be outlined as follows:

I. Inflammatory lesions as pharyngitis, laryngitis, syphilis of the larynx, laryngeal tuberculosis, tracheo-bronchitis, bronchitis, bronchiectasis, pulmonary tuberculosis, the pneumonias, lung abscess, diseases due to fungi, diseases due to parasites, pertussis, pleurisy, empyema thoracis and pneumoconiosis.

II. Pulmonary congestion.

III. Pulmonary edema.

IV. Aortic aneurysm.

V. Pulmonary infarction.

VI. Intrathoracic tumors.

VII. Foreign bodies.

VIII. Bronchial asthma.

IX. Lesions due to clinical irritants.—SKILLING, D. M., JR.: Differential diagnosis of conditions which produce cough and hemoptysis. Clinics 2: 1460-1510, April 1944.

MODIFIED INTENSIVE METHOD FOR TREATMENT OF PRIMARY AND SECONDARY SYPHILIS

HERMAN S. ZEVE
Commander (MC) U.S.N.R.

During the last quarter century many methods of treating syphilis have been advocated. In recent years a widespread interest has been focused upon more rapid and intensive technic. However the frequency of severe reactions and the necessity of continuously observing the patient while he is undergoing treatment has necessarily restricted the practical use of methods otherwise offering therapeutic, economic and sociologic advantages.

This report is based upon a series of cases treated by a modified rapid technic which represents a compromise between the older and newer methods. On the one hand under "average" rather than "exceptional" hospital conditions we have endeavored to obtain a maximum therapeutic response in the minimum of time, while on the other hand we have tried to chart a course in which severe or minatory reactions would occur, rarely, if at all. The indication for this procedure was justified on the basis of military expediency and the necessity of utilizing limited facilities to a greater degree of efficiency.

There are 142 cases of untreated primary and secondary syphilis included in this report, the majority representing infections acquired in South American and Caribbean ports. As a prerequisite to receiving intensive therapy each man was submitted to a general physical examination which included the usual blood and urine examinations, the latter being repeated at intervals throughout the treatment period. The patients were between 18 and 35 years of age, in good general physical condition with the exception that in many cases there were concurrent venereal infections. All the patients were restricted to the syphilis ward but complete bed rest was not deemed necessary. A well balanced diet, including citrus fruits and juices, and adequate water intake was provided for each patient. The amount of treatment a patient received was based upon an estimation of the extent and severity of the infection, his weight, and his response to therapy. This method was not used in the treatment of cerebrospinal, visceral, and latent syphilis or when serious concurrent diseases existed.

The biweekly and the modified intensive methods were first used

at the dispensary. After a preliminary observation period the modified intensive method was adopted as a routine and was continued at the hospital.

TABLE 1.—*Schedule of treatment*

Days of treatment	Number of treatments	Gm. of mapharsen per 10 cc. triple distilled water	Gm. of bismuth subsalicylate in oil
1	1	.03	0.13
2	2	.06	
4	3	.06	
6	4	.06	
8	5	.06	
10	6	.06	
12	7	.06	0.13
14	8	.06	
16	9	.06	
18	10	.06	
20	11	.06	
22	12	.06	

Rate of injection 10 to 30 seconds.

Dosage: 1 mg. per kg. Minimum 60 mg. Maximum 80 mg. Total 1,800 to 2,200 mg., 3 full courses.

Statistical summary.—The total number of cases treated between January 1943 and January 1944 was 142; in 62 of these a positive darkfield diagnosis was obtained, and both darkfield and Kahn positive in 34. Darkfields were negative or unobtainable in 46 but the Kahns were positive with clinical signs and symptoms. The total number of treatments given was 1,494; the average number of treatments per case, 10.52. An average total dose of mapharsen per case was 0.597 gm. The total number of treatment days required, using the modified intensive method, was 3,224 and the average number of treatment days required per case, 22.5.

The average number of days between treatments was 2.16. The estimated total number of days' treatment required, using single weekly method, was 10,458; the estimated total number of days of treatment required using the biweekly method, 5,229; and the total number of treatment days required, using the modified intensive method, 3,224. Days saved in relation to single weekly method were 7,234 or 19.8 years; the days saved in relation to biweekly method, 2,005 or 5.5 years. There was one mild drug reaction which lasted 24 hours; the reaction per number of patients was 0.7 percent; the reaction per number of treatments, .06 percent.

It will be noted that the average total amount of mapharsen each patient received approximated 0.6 gm. About 75 percent of the patients received more than 0.6 gm. of mapharsen before being discharged from the sick list. All of the remaining patients except four received 0.54 to 0.57 gm., but completed the estimated required amount of treatment for their first course as ambulatory patients under our supervision or at their base dispensaries. The

four remaining patients were transferred to other activities under treatment because of military expediency but only after lesions were healed. Five patients with advanced secondary lesions have completed three full courses with this method. These showed an early reversal of the Kahn reaction as well as clinical disappearance of signs and symptoms. No unfavorable therapeutic reactions were encountered.

Because of circumstances incident to other duties it was occasionally necessary to delay treatment for a day, but for the most part, the treatment schedule outlined was adhered to regularly. In addition many patients were required to remain on the sick list one or two days after completing their first course of treatment. These days are included as treatment days, since their exact number is unknown. It is obvious therefore, that the total number of treatment days has been artificially increased by nontherapeutic factors which, if they could have been excluded, would reduce the total number of sick days to somewhat less than 3,224. It was not possible within the scope of this investigation to determine what effect this method of treatment had upon the Kahn reaction.

SUMMARY

A total of 142 patients with primary or secondary syphilis received a modified intensive initial course of mapharsen therapy consisting of an average of 10.5 treatments in 22.5 days per man without any evidence of increased risk above that encountered in less intensive methods. Bismuth subsalicylate 0.13 gm. once a week supplemented the arsenical treatments.

The infection was treated intensively when the time element was important.

The duration of the infectious period was quickly reduced, as evidenced by rapid and complete healing of all primary and secondary lesions.

The average number of sick days for each patient was greatly reduced as compared with weekly or biweekly methods of treatment.

Patients were returned to a duty status with all open infectious lesions healed.

More patients were adequately treated by a limited number of medical personnel under conditions which were inadequate for prolonged periods of hospitalization.

The method is probably suitable for ambulatory patients but will require more experience before this can be definitely established.

The method is more practical for military dispensaries and hos-

pitals than any of the more intensive methods which are now being studied and used in specialized clinics.

Among the economic and military advantages of the method are: (1) The decrease in total cost per patient; (2) the number of man-hour days saved; (3) the increased efficiency of ships and stations by earlier return of trained and necessary military personnel to active duty; and (4) other desirable advantages accruing to the individual patient, his family, and the Navy.

From 1 January 1944 to 1 August 1944 an additional 65 patients have been treated with equally good results and no untoward reactions.



ADVANTAGES OF SUCCINYL SULFATHIAZOLE IN LARGE BOWEL SURGERY

The advantages of succinyl sulfathiazole in large bowel surgery are: The avoidance of temporary fecal fistula, of the crushing of spurs, of hernia through the site of closed fistulae, of repeated anesthetic hazards and of delay between stages for spread of malignancy, make a one-stage method a boon to both patient and surgeon. The saving of cost and of hospital bed space is an additional accomplishment.—ARCHER, H. L., and LEHMAN, E. P.: Clinical and laboratory experiences with succinyl sulfathiazole. *Ann. Surg.* 119: 518-524, April 1944.



INDICATIONS FOR BLOOD TRANSFUSION IN CASES OF HEMATEMESIS OR MELENA

1. A pulse rate of 140 or more per minute.
2. A hemoglobin of less than 5 gm. percent (less than 35 percent) or a red blood cell count of 2 million or less per cubic mm.
3. A systolic blood pressure of 90 mm. or less.
4. A blood urea nitrogen of 50 mg. percent or more, a persistent elevation or rising concentration.
5. Delirium or persistent headache.
6. Marked restlessness uncontrolled by other means.
7. General "poor appearance."—SCHIFF, L.: Treatment of bleeding peptic ulcer; with report of 160 cases treated by prompt feeding program. *South. M. J.* 37: 335-342, June 1944.

EVALUATION OF THE COLD AGGLUTINATION TEST IN PRIMARY ATYPICAL PNEUMONIA

JOHN H. L. HEINTZELMAN

Captain (MC) U.S.N.R.

and

ARTHUR W. SELIGMANN, JR.

Lieutenant (MC) U.S.N.R.

Primary atypical pneumonia has recently taken its place under various names as a definite entity that can be separated from the heterogeneous group of respiratory illnesses previously labeled pneumonitis and catarrhal fever. In the average case (1) the patient has only mild symptoms—malaise, low-grade fever, headache, and a dry or a productive cough with or without a preceding upper respiratory illness. The physical findings are meager, consisting usually of râles over the affected area. In the more severe and rare cases, dyspnea, cyanosis, and marked prostration occur. Definite diagnosis, particularly in patients with no objective physical findings, depends upon the x-ray examination.

Recently, following the pioneer observations of Peterson, Ham and Finland (2), Horstmann and Tatlock (3) and Turner and his coworkers (4) found the cold agglutination reaction a promising adjuvant in the diagnosis of this disease. It is our purpose to point out certain aspects of the use of this test which to our knowledge have not previously been emphasized.

The cold agglutination reaction is based on the presence in certain sera of agglutinins which cause clumping of homologous or group O red cells at low temperatures. To test for the presence of these agglutinins, serial dilutions of serum are mixed with washed suspensions of group O erythrocytes in normal saline solution. The tubes are allowed to stand overnight in a refrigerator at temperatures varying from 0° to 5° C. Readings are made the next morning, immediately on removal of the racks from the icebox, in the same manner as when obtaining the heterophil reaction for infectious mononucleosis. The technic employed is given in detail by Fetterman, Moran and Hess (5).

The test in itself is not infallible in the diagnosis of atypical pneumonia since all cases do not yield a positive reaction. Furthermore, cold agglutinins have been reported frequently in paroxysmal hemoglobinuria and trypanosomiasis. They have also been found in pernicious anemia, leukemia, lymphoblastoma, cirrhosis, venous thrombosis and gangrene (6), among others, but with great irregularity and inconstancy in any one disease, as Turner has

pointed out. Thus when considered together with the clinical picture, the test becomes virtually specific for atypical pneumonia. In the present study we have not concerned ourselves with the role of cold agglutinins in the production of transfusion reactions. This important aspect of the subject has been thoroughly discussed by Dameshek (7).

MATERIAL AND RESULTS

The cold agglutination test was employed in a series of 33 patients with primary atypical pneumonia admitted to a Naval hospital at a South Pacific base during a 4-month period. This series is limited to cases proved by x-ray examination. Twenty-two patients showed a positive titer, that is, a cold agglutination reaction in serum dilution of 1:32 or above, at some time during the course of their disease. In six instances the reaction became positive during the first week of illness, in two 48 hours after the onset of symptoms. These findings are contrary to those of Turner who had but one positive case, and Horstmann who reported none during the first week of illness in their respective series. It adds considerably to the diagnostic value of the test in certain cases and indicates that blood may be taken in the initial stages of the disease with some hope of obtaining a positive reaction which may lead to the solution of a diagnostic problem.

Blood in 10 cases in this series showed the first significant cold agglutinin titer during the second week of the disease. Some of these latter would perhaps have appeared earlier if the tests had been made sooner. In the 6 remaining cases, 2 became positive after the second week of the disease and 4 were tested too late to establish the date of onset with any degree of accuracy.

Although the proportion of high titers was greater among the sicker patients, no consistent relationship was observed between the severity of the disease and concentration of serum cold agglutinin. Thus of 5 patients who were severely ill, 3 showed titers of 1:128 or above. On the other hand, our sickest surviving patient never exceeded a titer of 1:64; and of 15 mildly or moderately ill patients, 7 had titers of 1:128 or above at some time. A larger series of cases might clarify this relationship. Peterson noted that high titers usually but not always occurred in the sickest patients.

The cold agglutination titer at times increased when the roentgenogram showed clearing or complete disappearance of the lesion. This explains the concurrence of positive test results with negative x-ray findings when the blood is not examined until late in the clinical course of the disease.

COMMENT

It is clear that many cases of primary atypical pneumonia will present no diagnostic difficulty which a careful history and physical and roentgenographic examination will not readily solve. It is also apparent that the cold agglutination test becomes positive late in the course of the disease or remains negative in a fair proportion of cases (11 out of 33 in our series and 12 out of 49 in Turner's). For this reason a positive reaction has considerably more significance than a negative one. As Turner has remarked, there may be some question as to the diagnosis in cases with negative reactions.

The test is best employed as an aid in cases in which other diagnostic methods have failed, rather than as a routine procedure. It may however be employed routinely provided reliance is not placed on a single negative result and repeated blood samples are studied throughout the patient's illness. The cases in which we found the cold agglutination reaction of most value were pneumonias of undetermined etiology, cryptogenic fevers, and upper lobe lesions suggestive of tuberculosis.

In pneumonias of undetermined etiology the detection of cold agglutinins permitted us to cease or to withhold sulfonamide therapy with confidence as most authors are agreed that primary atypical pneumonia does not respond to this type of treatment. Three patients had fever of undetermined origin and their original chest x-rays were reported as showing no parenchymal lesion. On the basis of positive cold agglutination reactions, further x-rays were requested and definite lesions of atypical pneumonia were subsequently demonstrated. Without the test, these patients would have been considered as cases either of catarrhal fever or acute bronchitis. Since one of these patients was seriously ill on admission, and another had been having an unexplained fever for over one month, the cold agglutination reaction had more than academic importance in indicating management of the condition.

Finally the test was found to be of considerable help in the evaluation of upper lobe lesions. Patients having such pathosis frequently require repeated sputum and x-ray studies over long periods of time to establish the presence or absence of pulmonary tuberculosis. The early determination of the nature of upper lobe infiltrations is particularly desirable in Naval and military hospitals outside the continental United States because patients who have tuberculosis must be evacuated to the mainland for proper treatment. They also require special handling. Often there is little time to decide whether a patient should be evacuated, and the cold agglutination test may aid in preventing unnecessary evacuation. In civilian

practice, the physician armed with a positive cold agglutination reaction can reassure the patient and family before the suspicion of tuberculosis has been eliminated by clearing of the chest film.

There were eight patients in this series who had lesions of an upper lobe. In six of these the diagnosis was established by the appearance of cold agglutinins. In two instances the agglutinin reaction remained negative throughout the course of the disease, but the lesions cleared completely as demonstrated by serial roentgenographic studies. Of the six patients who had positive agglutinin reactions all but one had a satisfactory clinical course. The exceptional patient was under observation for $2\frac{1}{2}$ months, and at the end of that time a sizeable lesion was still present in the right upper lobe of the lung. Repeated sputum tests were negative for acid-fast bacilli, and the patient was accordingly evacuated with the diagnosis of atypical pneumonia, unresolved. It is believed that this diagnosis is justified because other workers (4) (5) have shown that pulmonary tuberculosis does not lead to the production of cold agglutinins in significant amounts.

In one patient the cold agglutination reaction alone enabled the proper diagnosis to be made. This man had been ill for about $5\frac{1}{2}$ weeks with a dry cough, increasing dyspnea, and cyanosis. Definite pulmonary pathosis was demonstrated roentgenographically 5 days before admission, at another hospital. On the basis of the x-ray findings and the clinical picture, various diagnoses had been considered, including miliary tuberculosis, lymphangitic carcinoma, aspergillosis, and atypical pneumonia. The clinical consensus had been miliary tuberculosis. When admitted to this hospital, the patient appeared almost moribund with severe dyspnea and cyanosis relieved only partially by inhalation of 100-percent oxygen. Because of the unusual clinical picture, the nature of the disease was in doubt until the cold agglutination test was reported to be positive, indicating a diagnosis of atypical pneumonia. This case constitutes our one fatality, and the autopsy findings confirmed the clinical diagnosis.

SUMMARY AND CONCLUSIONS

1. In 33 cases of primary atypical pneumonia proved by x-ray, 22 demonstrated serum cold agglutinins in significant titer.
2. The early onset of a positive titer occurs more commonly than heretofore reported.
3. In our experience the cold agglutination test has proved valuable as an aid to the x-ray examination in upper lobe and obscure inflammatory lesions of the lung.

REFERENCES

1. DINGLE, J. H., and FINLAND, M.: Medical progress; virus pneumonias; primary atypical pneumonias of unknown etiology. *New England J. Med.* 227: 378-385, September 3, 1942.
2. PETERSON, O. L.; HAM, T. H.; and FINLAND, M.: Cold agglutinins (auto-hemagglutinins) in primary atypical pneumonias. *Science* 97: 167, February 12, 1943.
3. HORSTMANN, D. M., and TATLOCK, H.: Cold agglutinins; diagnostic aid in certain types of primary atypical pneumonia. *J.A.M.A.* 122: 369-370, June 5, 1943.
4. TURNER, J. C.; NISNEWITZ, S.; JACKSON, E. B.; and BERNEY, R.: Relation of cold agglutinins to atypical pneumonia. *Lancet* 1: 765-769, June 19, 1943.
5. FETTERMAN, G. H.; MORAN, T. J.; and HESS, W. R.: The cold agglutination test; 1. studies on Naval hospital patients; 2. studies on natives in a yaws endemic area. To be published.
6. STATS, D., and BULLOWA, J. G. M.: Cold hemagglutination with symmetric gangrene of tips of extremities; report of case. *Arch. Int. Med.* 72: 506-517, October 1943.
7. DAMESHEK, W.: Cold hemagglutinins in acute hemolytic reactions in association with sulfonamide medication and infection. *J.A.M.A.*, 123: 77-80, September 11, 1943.



ELECTROCARDIOGRAPHIC ABNORMALITIES IN YOUNG ADULTS

There are a number of physiological mechanisms which may alter the electrocardiogram, sometimes to an abnormal degree. In the age groups in which degenerative disease of the myocardium is rare, there is greater likelihood that a given electrocardiographic abnormality is a physiological variant than evidence of a pathological lesion. Until the limits of normal variation in the human electrocardiogram have been much more thoroughly explored, the diagnosis of heart disease in young persons should seldom be based on electrocardiographic findings alone, in the absence of clinical manifestations.—THOMAS, C. B.: Significance of electrocardiographic abnormalities in young adults. *Bull. Johns Hopkins Hosp.* 74: 229-239, April 1944.

LOBAR, BRONCHO-, AND ATYPICAL PNEUMONIA¹

A STUDY OF FIVE HUNDRED CASES

ALBERT W. HOBBY
Commander (MC) U.S.N.R.

The incidence and menace of the various types of pneumonias have materially changed in the past few years. Smiley (1) states that the median rate for acute pneumonia and pneumonitis for the past 61 years was 4.72 per 1,000; 5.33 per 1,000 in 1918, and from that time through 1941 the rate was 2.63 per 1,000. In 1942 the rate increased to 7.07 per 1,000. The death-rate curve declined steadily through 1936, and even more rapidly since that date.

Atypical pneumonia on the other hand first appeared in 1937 with the reporting of two cases or .02 per 1,000 personnel, and increased so rapidly that the rate in 1941 was .95 per 1,000 and 2.79 per 1,000 in 1942. Last year proved that it is still on the increase and in the future may have serious consequences, especially since we have as yet no satisfactory method of treatment. It has already surpassed lobar pneumonia and equaled bronchopneumonia in its incidence and is far more contagious than either of them.

A review of 500 cases of all types of pneumonia seen at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Maryland, from 1 October 1941 to 1 January 1944 is presented here. Included are 112 cases of lobar pneumonia, 62 of bronchopneumonia, and 326 of atypical pneumonia as shown in tables 1, 2, and 3. A further breakdown shows that 63.8 percent of the pneumonia cases in 1943 were atypical. There were only three deaths from all types of pneumonia. There were complications in only four instances, all of which were empyemas, and recovery ensued in all four.

TABLE 1.—*Monthly distribution for 1941*

Type of pneumonia	Oct.	Nov.	Dec.	Total
Atypical.....	2	2	4	8
Lobar.....	0	1	2	3
Broncho.....	1	1	2	4
Total.....	3	4	8	15

¹ Received for publication 1 March 1944.

TABLE 2.—*Monthly distribution for 1948*

Type of pneumonia	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Atypical.....	1	2	1	2	1	2	4	9	10	10	15	32	89
Lobar.....	0	2	3	3	3	3	0	3	4	4	3	6	34
Broncho.....	1	0	0	0	0	1	0	1	3	6	1	6	19
Total.....	2	4	4	5	4	6	4	13	17	20	19	44	142

TABLE 3.—*Monthly distribution for 1943*

Type of pneumonia	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Atypical.....	25	21	15	9	9	15	20	20	14	17	20	44	229
Lobar.....	6	5	6	12	8	3	0	3	4	3	3	22	75
Broncho.....	7	3	6	11	2	1	4	3	0	0	1	1	39
Total.....	38	29	27	32	19	19	24	26	18	20	24	67	343

Close observation of these cases and a review of the recent literature reveals certain changes both in the character of the disease and in its treatment.

For the sake of clarity these cases are divided into lobar pneumonia, bronchopneumonia, and atypical pneumonia and each is discussed separately.

On admission to the hospital all pneumonia patients in addition to a complete history and physical examination should have the following laboratory work: (1) Urinalysis; (2) erythrocyte sedimentation rate; (3) complete blood count; (4) sputum typing; (5) sputum smear for predominating organisms; (6) sputum culture; (7) x-ray (14 by 17 inches) of the lungs, and, if the patient is acutely ill a blood culture should be included. Immediately after this is done all pneumonias, with one exception which will be mentioned later, should be placed on a regime consisting of sulfadiazine, 4 gm. immediately and 1 gm. every 4 hours thereafter by mouth to be given with sodium bicarbonate; sedation as needed to prevent reaction to the sulfonamide and to insure rest; a moderate amount of fluids (2,500 cc. as a minimum per day); a laxative or enema as necessary to insure daily bowel movements; an oxygen tent when necessary, and absolute rest in bed.

LOBAR PNEUMONIA

In the diagnosis of lobar pneumonia the history is of great importance. In this study there was a scarcity of physical signs early in the disease. The patients usually were acutely ill, having high temperature, history of chills, pain in the chest, and cough produc-

tive of rusty sputum. In such cases the diagnosis should be made easily even in the absence of physical signs.

The first physical sign to be noted was the appearance of limitation of motion on the affected side and later impaired resonance and subcrepitant râles during deep inspiration or after coughing. The orthodox signs of lobar pneumonia, of dullness on percussion, bronchial breathing, and whispered pectoriloquy, appeared from the second to the fourth day. Early x-ray findings were often normal, but when frequent x-rays were taken they showed atypical lobar development in about 24 hours. The lobes involved in order of their frequency were the right lower lobe, the left lower lobe, the right middle lobe, and the right upper lobe. The management of this condition is the same as for bronchopneumonia.

BRONCHOPNEUMONIA

The illness usually is mild or moderately severe. Occurrence of symptoms in their order of frequency as observed in this study were cough, fever, chills, headache, malaise, sore throat, chest pain, backache, nausea and vomiting, and dyspnea. An upper respiratory infection for a day or two followed by sensations of chill, fever, cough, and malaise was the usual history. Cyanosis, dyspnea, tachycardia, and pleuritic pain were infrequently seen. Chest pain, described as a burning or raw sensation, usually retrosternal in location, was present in some cases.

Physical examination was in many cases inconclusive on admission. Upon examination of the lungs, dullness to percussion, impairment of tactile fremitus, and bronchial breathing when elicited, were minimal and present for short periods of a few days. Moist râles were noted in a large percentage of cases only after two or three days' observation. Signs of congestion, once obtained, persisted even though the patient was afebrile and felt well.

Cough was usually productive of a mucoid, often blood-streaked sputum. This symptom was controlled with small repeated doses of codeine, inhalations, and the use of oxygen tents. The temperature ranged from 99° to 106° F. Temperatures of 103° to 106° F. were of relatively short duration. The pulse and respirations were but slightly affected even in the presence of an elevated temperature. White blood cell counts varied from 5,000 to 20,000. They showed a slight increase in the percentage of polymorphonuclear neutrophils, even though the total leukocyte count was within normal limits. The order of frequency of the lobes involved was the left lower lobe, the right lower lobe, the right middle lobe, and multiple lobes. Roentgenographic studies showed pneumonic lesions

as discrete or confluent bronchopneumonic patches easily recognized. Although there are certain general principles to be adhered to in the treatment of bronchopneumonia and lobar pneumonia, each patient also must have individual consideration and treatment.

The initial procedures on admission have already been outlined. The single exception to the use of sulfadiazine, as mentioned previously, is atypical pneumonia with minimal clinical and x-ray findings. In bronchopneumonia and lobar pneumonia the sulfadiazine is continued until a normal temperature has been maintained for 2 days. At this time it is reduced to 1 gm. three times daily for 2 days and then discontinued. It has been found that in some cases the temperature almost but not quite reaches normal, and in such cases, if two of the 1-gm. doses each 24 hours are increased to 2 gm., then the temperature usually returns to normal and remains so. This increases the sulfadiazine level to 7 to 10 mg. per 100 cc. of blood. The sulfonamide concentration in the blood of 3 gm. per 100 cc. recommended by many has not been found as effective as the higher levels. Sulfa drug reactions were rare and almost universally due to lack of sufficient fluid intake.

Urinalysis every other day should be routine, for the appearance of occult blood indicates lack of fluids. Likewise a white blood cell count should be done every 48 hours. Other sulfa reactions include rash, elevated temperature (due to continuation of the drug over too long a period of time), mild nausea (frequently overcome by crushing the sulfonamide tablets in a small amount of water prior to swallowing), and mild disorientation. Constant observation of the patient and gaging of the dosage will minimize these reactions to the point where they may be considered insignificant. When nausea or mental symptoms contraindicate oral medication 5 gm. of sulfadiazine should be given intravenously followed by 2 gm. intravenously every 6 hours until oral therapy can be started.

Whenever sulfonamides are indicated but fail to produce the desired results or cannot be given for other reasons, penicillin may be used. Penicillin has produced excellent results. The total dosage used was 200,000 to 400,000 units over a period of 5 to 6 days. Intramuscular injections of 5,000 to 10,000 units were given every 3 hours day and night following an initial intravenous dosage of 20,000 units. The method of administration must be suited to the individual patient. The site of injections often became very painful, especially when there was a slight discoloration of the penicillin fluid. Reactions are very rare, the most frequent being a mild rash about 14 days after the drug is stopped.

The use of blood plasma in this series brought about dramatic

changes in the acutely ill. The exact chemistry of plasma as used is not understood. There are several plausible theories but space does not permit a discussion here. Three units of 250 cc. each, given on two successive days at the proper stage, caused dramatic improvement in all aspects of the disease. When any anemia was present, 500 cc. of whole blood was also administered following the plasma. Its use for very acutely ill patients is strongly urged.

General supportive measures, as sedation, expectorants, and tonics in convalescence, are well known. However, constant bed rest, and arrangement of medication so that the patient will not be disturbed too often should be mentioned. It must be remembered that this is an acute illness and the patient needs all possible rest. When pneumonia patients are treated in large wards they are apt to get out of bed or even to be too active in bed. This should be controlled by close observation. Complications will be discussed under atypical pneumonia.

ATYPICAL PNEUMONIA

The term atypical pneumonia, etiology unknown, is now officially used by the Navy and includes the following as compiled by Dingle and Finland (3): Acute influenzal pneumonia, acute pneumonitis, pneumonitis, acute interstitial pneumonitis, atypical pneumonia with leukopenia, atypical bronchopneumonia of unknown etiology, and disseminated focal pneumonia. In the study of cases at this hospital the term atypical pneumonia is used to include all these.

Eight patients with this diagnosis were admitted in October, November, and December of 1941, 89 in 1942, and 229 in 1943. A variety of symptoms was represented. Some had symptoms of almost every disease except atypical pneumonia on admission and required close observation and study to arrive at the correct diagnosis, corroborating Lusk and Lewis' (4) observation that "The course is bizarre, confusing, confounding and unpredictable."

Suttenfield (5) states that, "Its etiology, mode of transmission, communicability, mode of entrance, and period of incubation are not established. The same is true of its pathology, pathologic physiology, immunology, epidemiology, and treatment." He defines it as a form of pneumonia apparently caused by a filtrable virus. Eaton, Martin and Beck (6) found that the causative agents were probably related to the viruses of psittacosis, and of meningopneumonitis. Rake, Eaton and Shaffer (7) found them to be similar to the virus of lymphogranuloma venereum, whereas Smadel, Green, Paltauf and Gonzales (8) found them to be similar to the virus of lymphocytic choriomeningitis.

Reimann, Havens, and Price (9) likened the virus to those of influenza, chickenpox, smallpox, and the so-called mongoose-infecting virus. Likewise they state that a group of certain agents, aside from the viruses, have also been regarded with suspicion, as the rickettsia of "Q" fever, the protozoan toxoplasma, and the fungus *Coccidioides immitis*. All these may cause disease resembling the pneumonias caused by viruses.

The variety of the symptoms indicates that there must be more than one type of causative agent. The influence of sex, age, color, susceptibility, immunity, and other predisposing factors are unknown; however most of the cases reported are in the young military personnel, both male and female. It appears in all climates and at all seasons. The bacteriology is as yet unknown, but the disease is highly communicable.

The anoxemia rather than the toxemia appears to be the cause of cyanosis and dyspnea. There is a large element of pulmonary edema in the acute cases. Death rates are so low that insufficient autopsy reports have been accumulated accurately to portray the pathologic changes.

Suttenfield again states:

It seems that the entire respiratory tract is inflamed from above downward with an interstitial pneumonitis (fibrositis) being the main feature. As one recalls fibrositis is a non-suppurative inflammation of fibrous tissue anywhere in the body, the pathology of which is essentially a serofibrinous exudate with inflammatory hyperplasia. Such a concept explains the main features in primary atypical pneumonia, especially the early roentgen findings and the development later of the physical findings in the chest. Only an interstitial involvement in the lung would produce such a combination of roentgen and physical findings.

First, the alveoli would be air-bearing early in the course, giving essentially normal pulmonary resonance and no râles, but the interstitial fluid would add the density to the lung as seen in the roentgenogram. Second, by swelling, the stasis, eventual seepage into the alveoli producing the moist râles, and "wet lung" picture could occur. Third, the interstitial swelling with stasis and the wetness of the alveoli would account almost quantitatively for the anoxemia, cyanosis, and dyspnea whenever they occur. Fourth, that diapedesis does not occur with subsequent consolidation within the alveoli is attested by the presence of muco-tenacious sputum only occasionally tinged with bright red blood instead of the typical rusty sputum seen in pneumococcus pneumonia. Fifth, the absence of toxic action on the pulmonary capillary bed and the low systemic toxicity are in the same direction. Sixth, this entire series of events is consistent with the roentgen findings throughout the course of the disease.

Symptoms.—The incubation period is unknown, but is about 2 weeks in those cases in which there was only one exposure. As stated previously the onset was markedly varied in this series.

Reports by Allen (10), Reimann (11), Green and Eldridge (12), and also Whiteley, Bernstein and Goldman (13) bear out this finding. Correll and Cowan (14) found that the onset was sudden and was accompanied by a sharp rise in temperature, which is the reverse of the observations in this series. Daniels (15) and Murray (16) also state that the onset is rapid.

In this series the onset has simulated a very acute cold without the profuse nasal drainage, coming on gradually with moderate malaise, moderate temperature, drenching sweats and chilly sensations, and dry cough with almost normal pulse rate and respirations. If and when the disease becomes more acute, headaches, aching, chills, severe cough, sore throat, high temperatures, a pleuritic type of pain in the chest, hysteria, confusion, nausea, abdominal pain, incontinence, meningism, and diarrhea may occur, with the accent on any one of these symptoms. Loss of weight is a very constant factor. If the physician does not see the patient before this stage is reached, he may miss the diagnosis until an x-ray of the chest is taken.

Haight and Trolinger (17) state:

Unfortunately in a large percentage of cases the signs do not appear until the pulmonary involvement is actually clearing or "resolving," usually while the patient is coughing and expectorating. Many cases, nevertheless, manifest throughout the illness a suppression of breath sounds over the involved regions; this sign we found to be the most common and reliably localizing of any physical findings.

In 1927 Majors (18) called attention to an atypical pneumonia without temperature disturbance, without chill, and with little or no pain.

In this study the chest was found to be negative to auscultation and percussion for the first 48 hours of the disease. Then fine râles which soon became coarse were usually heard. Examination of the chest, however, may be more confusing than helpful and only be further confounded by the x-ray report. Nevertheless the physical findings should never be minimized until after viewing the x-ray of the chest. Laboratory studies were of little value in the diagnosis. The erythrocyte sedimentation rate was increased, but conclusive evidence was found only in the x-ray of the chest. Even these x-ray findings were at first negative. Negative findings, such as normal blood counts which later became slightly elevated, and negative sputum reports, should be considered significant.

After a few days the cough became productive of mucotenuous sputum and was rarely blood streaked. The chest findings were little changed and it should be noted that no evidence of con-

solidation was found. Fever was a variable factor, uninfluenced by sulfa drugs and lasted 7 to 14 days. It was usually out of proportion to the general appearance of the patient. The patient seemed almost well at times and hardly ever was as sick appearing as the fever would indicate. The x-ray findings varied as much as the symptoms, but not in direct ratio. No satisfactory classification of the x-ray evidence has yet been evolved. Bowen (19) states that the shadow "extends outward from the hilus well into the parenchyma, occasionally reaching the periphery. The appearance is that of a confluent mottled or rounded area, usually of homogeneous moderate density in the central portion, with borders fading into the normal lung," but x-rays in this study have shown that the same type of shadow may occur anywhere in the lung. Rarely was it found in the apices, but usually in the lower half of either lung.

Again Correll and Cowan state:

There is no definite characteristic roentgen appearance of this inflammatory disease of the lung. It usually presents a hazy, soft, string-like infiltration extending out of the hilus into the periphery of the lung. The process is most frequently noted in the lower lobes. However, there are two other roentgen types: One in which the film reveals a dense circum-hilar shadow with a fan-like infiltration into the surrounding lung tissue; the other type simulates in appearance the atelectasis of a lobe in that there is usually a diffuse veil-like shadow which occupies about two-thirds of the lobe. In our series of cases this type has never involved the entire lobe. There is no associated shift of mediastinal structures as one observes in a true atelectasis of the lung, and in addition, as the process resolves it takes on the appearance of the first type of primary atypical pneumonia. . . . Certain stages of broncho- and lobar pneumonia may stimulate primary atypical pneumonia. Severe forms of acute bronchitis may present a similar roentgen picture, so that, in the final analysis of the film, the clinical picture must be carefully reviewed in making an interpretation of the radiograph.

Atypical pneumonia can easily be confused with tuberculosis. Great care should be exercised not to give x-ray therapy in these borderline cases. The sulfonamides are apparently useless, but sulfadiazine was given for the first 3 days in this series and several cases of atypical pneumonia showed a sudden, marked response to the drug. This is unexplained; there is no proof that it sterilizes the other organisms in the respiratory tract, thereby preventing secondary invaders. It should not be employed longer than 3 days; its continued use will not prevent secondary invaders and its value for combating them later would thereby be lost.

As soon as the x-ray and laboratory work have definitely confirmed the diagnosis of atypical pneumonia (and ruled out tuberculosis) the patient should be given the benefit of x-ray therapy even though it is of doubtful value. In this series it is the impression

that the average number of hospital days has been reduced one-fifth to one-fourth by its use. If x-ray therapy is used, five to seven treatments should be given and the dosage varied according to the extent of the involvement shown in the x-ray film. It has been found definitely to relieve the cough and chest discomfort, and is thought to aid in resolution. In this series oxygen tents were used when needed. Absolute rest in bed is essential. Exercise has been found to prolong the period before the x-ray evidence disappears.

COMPLICATIONS

Complications in this series were rare. The most common was pleurisy with effusion which developed into an empyema. This condition was found only four times in this study; in three instances it followed lobar pneumonia and in one virus pneumonia complicated by secondary infection. Other rare complications have been reported elsewhere as encephalitic syndrome, cardiac dilatation, suppurative involvement of sinuses and mastoids, peritonitis, and others of even rarer nature.

The complications of bronchopneumonia and lobar pneumonia differ from those of virus pneumonia in that in the former there is no lessening of the acuteness of the illness prior to the onset of the complication, whereas the virus pneumonia may appear to be almost cured before the complication develops.

In uncomplicated pneumonias x-ray examination is not necessary more often than every 7 days, but is required immediately on noticing any of the following: (1) Increased cough; (2) failure of the temperature to drop to normal; (3) chills after onset of the disease; (4) drenching sweats; (5) marked increase in the white blood cell count; (6) increased discomfort in the chest; (7) unusual insomnia; (8) further loss of appetite; or (9) unusual symptoms or changes other than those found in resolving pneumonia. The patient should also have a blood culture and a repetition of the admission laboratory work. Secondary invaders and complications are usually thus heralded.

Treatment.—Sulfonamide therapy should be instituted at once. If immediate response is not obtained from the sulfa drug and if the blood culture is positive for bacteria that are responsive to penicillin, the sulfonamide may be supplemented or substituted by penicillin.

Saline and glucose are withheld and instead 3 units of plasma and 250 cc. of whole blood are given each day as is also a high protein diet to maintain a positive nitrogen balance which facilitates the action of the chemotherapy. This procedure may prevent effusion or even lessen the effusion already present. Large quantities

of protein are lost in pleural effusions, and the general condition of the patient is precarious at that time. His digestion and assimilation of food is poor and loss of weight is usually marked. After the onset of an uncontrolled secondary infection effusion may be noted, and usually has been found to contain hemolytic streptococcus or the pneumococcus.

The chest should be tapped for diagnostic purposes, a culture, smear, cell count, specific gravity determination and guinea pig inoculation being done on the pleural fluid. The effusions following atypical pneumonia are notorious for the large amount of fluid accumulating in a short period of time, often as high as 2,400 cc. in the first 30 hours, causing marked distress to the patient. Under these conditions, tapping is repeated as often as necessary.

A word about caution in performing a thoracentesis. Complete sterility is necessary at all times. Closed technic is essential. One out of every 10,000 thoracenteses have fatal results even under the best technic. If the closed technic is not observed, a pneumothorax will be caused if a negative pressure is exerted in the pleural space by withdrawal of fluid or shifting of the mediastinum. If the effusion becomes thick and purulent, frequent drainage will decrease the size of the space, aid in walling off the pus, and hasten recovery from surgical drainage. It sometimes becomes necessary to induce a pneumothorax when withdrawing fluid, because of increased coughing of the patient from expansion of the lung, especially if the pneumonia has not resolved, and also to facilitate x-ray interpretation.

Penicillin has been used liberally intravenously and intramuscularly in effusion and empyema, and at the same time from 100,000 to 200,000 units have been injected into the pleural fluid each time the chest was tapped.

It may be said with reasonable certainty that as long as the effusion is transparent or moderately turbulent, either a sulfonamide or penicillin may sterilize the fluid and obviate surgical procedure. However once the fluid has become thick and purulent it cannot be sterilized and operation should be done as soon as the empyema has been walled off sufficiently.

COMMENT

It is obvious that this series is in the age group that has the lowest death rate. Most of the deaths reported in the literature occurred below the age of 1 year or over the age of 50 years. Only one patient in this series who died was under 30 years and one was 65 years old. The cause of death in the one atypical pneumonia was

a secondary infection complicated further by asthma and cardiovascular-renal disease.

Misconceptions are to be expected in a disease of so many variations as are found in atypical pneumonia. The condition should not be considered as a disease entity but as a phase of an upper respiratory infection which has gravitated to the lungs. Further it may be stated that a similar condition was found in the lungs of Civil War soldiers and therefore it cannot be considered a new disease. Many writers have confused the picture by considering an atypical pneumonia in which secondary invaders are present as a purely atypical pneumonia.

If one subscribes to the descending upper respiratory infection theory, the variability of the symptoms, course, and x-ray findings can be explained by the phase of the infection. Lusk and Lewis state that:

When the upper respiratory tract is affected, the condition may be designated as a nasopharyngitis, a laryngitis or a laryngotracheitis. So, when the infection extends into the lung, we find it takes on certain characteristics depending upon what portion of the pulmonary tract is predominantly affected.

Thus we find on the basis of physical and x-ray examinations, and to some extent on the course, the syndrome may be divided into the bronchitic, the peribronchitic, the alveolar, and the broncho-alveolar. Although any of these phases may exist independently of the other, more often several phases coexist. Equally often one phase merges into another; hence it is to be remembered that the terms as used only apply to that part of the pulmonary parenchyma predominantly affected, and that any parts may be involved simultaneously or successively.

SUMMARY

1. Five hundred cases of pneumonia occurring at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Maryland, are reviewed.
2. Atypical pneumonia is shown to be increasing each year.
3. The management and care of bronchopneumonia, lobar and atypical pneumonia are outlined.
4. The literature on atypical pneumonia is reviewed and the condition is described in detail.
5. A clearer concept of atypical pneumonia is discussed.

REFERENCES

1. SMILEY, D. F.: Incidence of acute respiratory infections; experience of the U. S. Navy since 1881. U. S. Nav. M. Bull. 42: 17-26, January 1944.

2. ALLEN, E. V., and BAIRD, L. W.: Pneumonia in the Army. New Orleans M. & S. J. 96: 177-184, November 1943.
3. DINGLE, J. H., and FINLAND, M.: Medical progress; virus pneumonias; primary atypical pneumonias of unknown etiology. New England J. Med. 227: 378-385, September 3, 1942.
4. LUSK, F. B., and LEWIS, E. K.: Atypical pneumonia of unknown etiology, a clinical, roentgenological and pathological correlation. Dis. of Chest. 10: 19-40, January-February 1944.
5. SUTTENFIELD, M. D.: Primary atypical pneumonia (virus pneumonia). Mil. Surgeon 93: 360-364, October 1943.
6. EATON, M. D.; MARTIN, W. P.; and BECK, M. D.: Antigenic relationship of viruses of meningopneumonitis and lymphogranuloma venereum. J. Exper. Med. 75: 21-33, January 1942.
7. RAKE, G.; EATON, M. D.; and SHAFFER, M. F.: Similarities and possible relationships among viruses of psittacosis, meningopneumonitis, and lymphogranuloma venereum. Proc. Soc. Exper. Biol. & Med. 48: 528-531, November 1941.
8. SMADEL, J. E.; GREEN, R. H.; PALTAUF, R. M.; and GONZALES, T. A.: Lymphocytic choriomeningitis; 2 human fatalities following unusual febrile illness. Proc. Soc. Exper. Biol. & Med. 49: 683-686, April 1942.
9. REIMANN, H. A.; HAVENS, W. P.; and PRICE, A. H.: Etiology of atypical ("virus") pneumonias with brief resume of recent discoveries. Arch. Int. Med. 70: 513-522, October 1942.
10. ALLEN, W. H.: Acute pneumonitis. Ann. Int. Med. 10: 441-446, October, 1936.
11. REIMANN, H. A.: Acute infection of respiratory tract with atypical pneumonia; disease entity probably caused by filtrable virus. J.A.M.A. 111: 2377-2384, December 24, 1938.
12. GREEN, D. M., and ELDRIDGE, F. G.: Primary atypical pneumonia, etiology unknown. Mil. Surgeon 91: 503-517, November 1942.
13. WHITELEY, J. H.; BERNSTEIN, A.; and GOLDMAN, M. J.: Primary atypical pneumonia—report of 25 cases. Mil. Surgeon 91: 499-502, November 1942.
14. CORRELL, H. L., and COWAN, I. I.: Primary atypical pneumonia; analysis of therapeutic results in 155 cases. U. S. Nav. M. Bull. 41: 980-987, July 1943.
15. DANIELS, W. B.: Bronchopneumonia of unknown etiology in girls' school. Am. J. M. Sc. 203: 263-276, February 1942.
16. MURRAY, M. E., Jr.: Atypical bronchopneumonia of unknown etiology possibly due to filterable virus. New England J. Med. 222: 565-573, April 4, 1940.
17. HAIGHT, W. L., and TROLINGER, J. H.: Primary atypical pneumonia, etiology unknown. U. S. Nav. M. Bull. 41: 988-1,000, July 1943.
18. MAJORS, W. M.: Atypical pneumonia. J. Arkansas M. Soc. 23: 154-156, February 1927.
19. BOWEN, A.: Acute influenzal pneumonitis. Am. J. Roentgenol. 34: 168-174, August 1935.

GASTRIC DISEASES IN NAVY PERSONNEL

A STUDY OF 191 GASTROSCOPIC EXAMINATIONS

RALPH H. LOE

Lieutenant Commander (MC) U.S.N.R.

and

EDMUND H. BERGER

Commander (MC) U.S.N.R.

The introduction of modern gastroscopy in 1932 and its subsequent development has been a valuable aid in the differential diagnosis and management of gastric diseases. There has been very little written on the subject of gastroscopy in the military services and it was felt that it might be worth while to present the gastroscopic experiences at this Naval hospital during the past year. In a younger healthier group the incidence of certain pathologic findings might be expected to differ from that found in civilian practice, since many of the gross pathologic gastric cases were screened out by the induction examining boards. It is the purpose of this paper to review the clinical findings and to demonstrate the value of gastroscopy in the differential diagnosis and care of upper abdominal distress in Navy personnel.

We consider gastroscopy a procedure to be used supplementary to a careful history and physical examination, in addition to laboratory work and a roentgen examination. Our indications for direct visualization of the stomach fall into the following seven groups.

1. Upper abdominal complaints with negative roentgenologic findings. This group will include most of the inflammatory lesions and unexplained gastro-intestinal hemorrhages.

2. Achlorhydria or an achylia gastrica. The possibilities to be considered in this group are cancer and atrophic mucosal changes.

3. Indefinite roentgenologic findings.

4. The differentiation between benign and malignant gastric ulcer. This also includes that group in which it is possible to observe the complete healing of a benign ulcer when it is being treated medically.

5. Postoperative gastric symptoms. Gastroscopy in this group is particularly valuable because of the difficulties encountered in this examination by the roentgenologist.

6. Duodenal ulcers not responding to treatment. For example, an associated gastritis may occasionally be the explanation for slow response to therapy.

7. Carcinoma of the stomach. Direct visualization may be an aid in determining the type and extent of the lesion preoperatively.

During the past year 191 gastroscopic examinations were made

on 143 selected patients. The patients were grouped and their disposition indicated as shown in table 1.

TABLE 1.—Disposition of patients

Diagnosis	Disposition				
	Duty	Limited duty	Invalid. from service	Miscellaneous	Total
Chronic superficial gastritis.....	10	3	12	—	25
Hypertrophic gastritis.....	4	2	15	—	21
Atrophic gastritis.....	5	—	2	—	7
Gastric ulcer.....	—	1	3	1 trans.	5
Carcinoma of stomach.....	—	—	1	1 VAP	2
Stomach, postoperative.....	1	2	1	2 VAP	6
Normal stomach.....	41	2	17	14 NP. 1 died 2 dependents	77

Chronic superficial gastritis.—Chronic superficial gastritis was diagnosed in 25 cases. Gastroscoically this picture is recognized by increased redness, edema and exudation occasionally associated with submucosal hemorrhages and superficial ulcerations. These cases are amenable to therapy, but if left untreated have been known to progress to atrophy. This inflammatory process was associated with one other condition in a case of duodenal ulcer and questionable prepyloric ulcer. There was no clearcut diagnostic pattern of symptoms that we were able to discover that would enable us to determine that this particular patient probably had chronic superficial gastritis.

In none of these patients did profuse gastro-intestinal hemorrhage occur. In some the symptoms were ulcer-like. The majority, however, experienced periods of more or less constant distress lasting a few days, weeks or months. The discomfort was at times described as a burning or gnawing sensation, at other times associated with a severe cramp and was usually aggravated after meals. The symptoms of nausea and vomiting, particularly after breakfast were not an uncommon complaint. The distress was invariably diffusely epigastric as was the area of tenderness. This was the only physical finding of importance. The free hydrochloric acid values were found to be variable. In two cases achlorhydria was present. This finding is not surprising, since the end stage of this condition may be atrophy of the gastric mucosa.

The treatment consisted of a bland diet and aluminum hydroxide gel, 4 to 8 cc. five times daily. The stomach was lavaged night and morning when relief was not prompt. Improvement occurred in all cases treated. In 6 instances where the history was of less than 1-year duration complete relief was obtained and subsequent gastroscopic examinations revealed entirely negative findings. It

has been observed that relief occurs before healing is complete. This is also true in ulcer patients.

Case report.—A storekeeper, first class, 32 years of age, had experienced periods of epigastric distress since 1932 compelling him to watch his diet carefully in order to be reasonably comfortable. X-ray examination when he was in civilian life showed negative results. During the last 2 years the discomfort had been more or less constant owing to gaseous distention immediately after meals. Two to three hours after meals a full epigastric pain occurred which was relieved by food and alkalies. He lost 25 pounds of weight and complained of nervousness and insomnia. Physical examination revealed nothing abnormal. Laboratory examinations, including the gastric analysis, were normal. X-ray of the stomach showed normal findings. Gastroscopic examination showed marked redness, edema and exudation from the body and fundus of the stomach. The treatment consisted of bland foods, aluminum hydroxide gel, vitamins, and gastric lavage. Response to treatment was slow.

This patient is representative of an exceptional group of three patients in whom psychogenic factors were important and contributed to the refractoriness of the condition. Whatever the immediate causes of gastritis may be, it is our impression that the elimination of emotional disturbances is as important in the successful management of these cases as in ulcer patients.

Hypertrophic gastritis.—Hypertrophic gastritis was diagnosed in 21 cases. Gastroscopecally this is characterized by a loss of high lights, dryness and nodularity, at times giving a cobblestone appearance. Erosions may be present and hemorrhage is not infrequent. Pathologically there is a hyperplasia of the epithelium and an increase of the normal plasma cell and lymphocytic infiltration.

This condition was associated with duodenal ulcer in four cases, with carcinoma of the stomach in one, and gross gastro-intestinal hemorrhage in four cases. The characteristic symptom complex was gastric distress, usually diffuse in nature and of long standing, variable in degree, and with short periods of comparative comfort. In one-half of the cases pain was ulcer-like, occurring several hours after meals. Relief, however, was not so readily obtained as in the treatment of uncomplicated peptic ulcer.

In the remaining half of this series discomfort was more or less constant, with periods of exacerbation commencing immediately after meals and often associated with morning nausea and vomiting. Pain not infrequently occurred at about midnight or 0400. Tenderness was more apt to be diffuse and was usually mild in contrast to the localized type found in ulcer. When the area of stomach involved in the inflammatory process was small the tenderness was less diffuse. Gastric analysis disclosed free hydrochloric acid to be present to a variable degree in all cases.

All of the patients improved symptomatically while under treat-

ment, but the response was incomplete, as they continued to have periodic distress. Therapy consisted of a bland diet rich in vitamins, and aluminum hydroxide or Sippy powders, whichever gave the most relief. Gastrosopic examinations made at intervals of 2 or 3 weeks were essentially unchanged.

Case report.—The patient, 18 years of age, was admitted to the sickbay because of constant epigastric distress from which he had never been free for more than a month since the age of six. The periods of pain usually lasted from 1 to 3 months. The symptoms increased in severity during his 2 months of service in the Navy. The pain was constant, localized to the epigastrium over a fair-sized area, dull and gnawing in type, aggravated by food and relieved temporarily by alkaline powders and vomiting. A 20-pound weight loss occurred during the 2 months prior to admission.

The physical examination was negative except for diffuse epigastric tenderness. The blood, urine, and Kahn tests were negative, the free hydrochloric acid was 32 degrees, and the gastro-intestinal x-ray findings were negative. Gastrosopic examination showed diffuse nodularity of the body of the stomach especially along the lesser curvature. The diagnosis was hypertrophic gastritis.

Reponse to treatment was fair, relief for a few days being followed by days of discomfort. On three occasions he complained of severe cramping pains in the epigastrium which were of such severity as to cause him to roll about in bed. The abdomen was not rigid. He was relieved during these attacks and could be made to sleep by the administration of 0.4 gm. of sodium amytal intravenously. The gallbladder x-rays were negative and it was considered that his pain was due to spasm associated with his gastritis.

This case is of interest because of the history dating since childhood. Without gastroscopy a definite diagnosis would have been impossible.

Duodenal ulcer with hypertrophic gastritis.—This condition was encountered in the following case.

Case report.—A seaman, second class, 19 years of age, was admitted to the sick list complaining of a dull steady epigastric pain which first began 2 years previously and which was worse 2 or 3 hours after meals and was eased by food and sodium bicarbonate. About 1 year before admission the symptoms became aggravated and occurred daily, immediately following meals and also 2 or 3 hours later.

Physical examination revealed moderate diffuse epigastric tenderness. Laboratory examination showed a normal blood count; urinalysis and Kahn test were negative, the free hydrochloric acid was 49 degrees. Gastro-intestinal x-rays showed the presence of a duodenal ulcer.

Response to routine ulcer treatment was not satisfactory and the distress continued. Gastrosopic examination was then performed and showed a moderately diffuse hypertrophic gastritis to be present. Because the condition existed prior to enlistment and failed to respond to therapy, this man was surveyed. This patient illustrates the fact that peptic ulcer and chronic gastritis may coexist and in this instance probably explained the failure to respond to treatment.

Atrophic gastritis.—Atrophic gastritis was diagnosed in 7 cases. The atrophic changes may be patchy or complete. The mucosa of

the stomach appears thin, the rugae are less prominent and the color is usually a grayish, or greenish-blue tinge. Branching blood vessels may be seen shining through the thin mucosa. Upon histologic examination the mucosa is thin and the glands are simple, tubular in type and lined with simple mucoid-secreting epithelium which gives the appearance of intestinal mucosa. Achlorhydria was present in each instance of this group. One of the patients had pernicious anemia and had an associated posterolateral sclerosis.

Case 1.—The patient, 37 years of age, had had 2 years of more or less constant epigastric burning pain. Two months prior to admission he began to have ulcer-like distress coming about 2 hours after meals. Some weight loss was present. Roentgenologic examination of the gastro-intestinal tract revealed no abnormal findings. Gastroscopic examination revealed patchy atrophy of the stomach.

Response to therapy was poor and on reexamination an ulcer about 2 cm. in diameter was seen high on the posterior wall of the greater curvature. Because of the absence of free hydrochloric acid and the character of the ulcer, malignancy was suspected. Surgical exploration was refused.

Case 2.—A man 40 years old presented himself because of gaseous distress and chronic recurrent diarrhea. Amebiasis had been diagnosed in 1926 and it was considered to be the cause of his present complaint, although no amebae were found. Gastroscopic examination showed a small area of atrophy on the lesser curvature of the stomach. Dilute hydrochloric acid relieved the symptoms completely and he was returned to duty.

Gastric ulcer.—Gastric ulcer was found in 5 cases. The experienced can usually differentiate the benign from the malignant ulcer although we have seen instances in which this was impossible. The benign ulcer is usually found to be a clean-cut, punched out lesion with perhaps some inflammatory reaction about it. The malignant ulcer may have some nodularity of its edge or base, with the appearance of lateral infiltration, and often one edge of the crater may have a gradual slope. We are, however, much more confident of our diagnosis when repeated observations can be made while the patient is on medical management. During medical treatment for gastric ulcer, gastroscopy alone will indicate when healing has taken place.

In this group of four cases, three men were over 40 years of age, while one was 24 years old. In the latter case only, was a lesion seen by the roentgenologist. The prepyloric ulcer found was not seen gastroscopically; however two superficial posterior wall ulcers were seen which were not visualized by the x-ray. Surgery was refused.

All four of these patients gave typical ulcer stories. Free hydrochloric acid was present in all. One, a Veterans' Administration patient, failed to cooperate and was discharged. Another, a chief water tender, was x-rayed in four different hospitals with negative

findings. Gastrosopic examination showed a large calloused ulcer high on the posterior wall of the lesser curvature. Repeated gastroscopic examinations showed failure to heal and at his request he was transferred to another hospital close to his home for surgery.

Case report.—A chief gunner's mate, 42 years of age, had a period of epigastric distress in 1937, at which time x-rays showed the presence of an ulcer. He responded to therapy and was symptom free until his present episode. About 20 September 1943 while in transit to this country from England, he began to have epigastric distress which came on one-half to one hour after meals and was eased by milk of magnesia. The pain also came on about midnight.

Physical examination was negative, except for diffuse epigastric tenderness. Routine laboratory examinations were negative. Free hydrochloric acid was 50 degrees. X-ray examination of the stomach revealed objectively nothing definite. There was, however, tenderness to palpation during the course of the examination. Gastrosopic examination showed a benign appearing ulcer 2 cm. in diameter on the posterior wall of the body of the stomach with considerable circumferential edema and redness. On the lesser curvature anteriorly above the angle a second ulcer slightly smaller than the one previously mentioned was visualized. There was very little surrounding reaction. Medical management brought prompt relief of symptoms and 3 weeks later the ulcers appeared definitely smaller on gastroscopic examination.

These cases illustrate how gastroscopy may supplement roentgenology in the diagnosis of gastric ulcer. It should, however, be recalled that the entire stomach cannot be visualized and consequently the x-ray may show an ulceration not visible gastroscopically. The character of the lesion may be determined with reasonable certainty and such lesions may be followed during treatment. By means of gastroscopy the response of the ulcers may be accurately observed and the benignancy of the lesions ascertained with a high degree of accuracy.

Carcinoma of the stomach.—Gastroscopy has been an aid in determining the operability and type of carcinoma of the stomach. It rarely may be the only means of discovering the presence of such a lesion, as in the case reported under the heading of atrophy.

Case report.—The patient, 48 years of age, was found to have a gastric ulcer in the proximal part of the body of the stomach near the greater curvature 1½ years ago. Gastroscopic examination after admission revealed an ulceration which appeared to be malignant. Surgical exploration revealed the presence of the ulcer which had the appearance of being benign. A partial gastric resection was accomplished without difficulty. Pathologic examination later substantiated the gastroscopic impression, proving the lesion to be malignant.

Stomach, postoperative.—We have gastroscoped 6 patients who have had gastric surgery performed. Four of these patients had had gastric resections, in the other 2 instances posterior gastroenterostomy had been performed. (The civilian experience of one

of the authors covered a series of 75 cases of this type observed over a period of 7 years.) The frequency with which marked inflammatory lesions of the stomach following radical surgery occurs has been impressive. Gastritis may or may not be associated with marginal ulcerations. Gastroscoically jejunal ulcerations usually cannot be seen, although occasionally the instrument will slip into the jejunum and permit its visualization.

Case 1.—A seaman, first class, 21 years of age, sustained a blow in the epigastrium while on his way to boot camp. He began to have ulcer-like distress, but x-ray studies were negative. Response to treatment was poor. During his second period of hospitalization the abdomen was explored and two duodenal ulcerations were found in the second portion of the duodenum. A high partial gastric resection was performed. Surgery did not give him much relief and he continued to complain of a diffuse, constant, epigastric distress. During the ensuing three months gastroscopy revealed marked edema and inflammation of the area of the stomach surrounding the stoma, which failed to improve under medical management. He was surveyed from the Navy.

Case 2.—A chief water tender, 40 years of age, had a partial gastric resection in another Naval hospital in March 1942 for a chronic duodenal ulcer which had perforated 2 months previously. He was rendered quite free from gastric distress and upon return to duty was told that dietary restrictions were unnecessary. In February 1943 he began to notice weakness and edema of the ankles. His diet was considered adequate although he drank beer regularly.

The free hydrochloric acid in the gastric analysis was 19 degrees and the serum protein 5.64 gm. X-ray examination of the stomach revealed a partial gastrectomy and hypermotility. Gastroscopy demonstrated gastritis to be present about the stoma. It was our opinion that the edema could most likely be explained on a nutritional basis. After appropriate treatment he was returned to duty.

On 11 November 1943 this man was again admitted to the hospital. He had progressed quite satisfactorily for a period of time when he again began to regurgitate his food on moving about after meals. He restricted his food intake and drank considerable beer which seemed to give him relief. He complained of nervousness and the corners of his mouth and the tip of his tongue became sore.

Physical examination showed that the tongue was red and the papillae on the tip were atrophic. Inflammation was also present about the corners of the mouth. Free hydrochloric acid at this time was zero. Gastrosopic examination showed that the mucosa was markedly inflamed and covered with exudate. On a bland diet, gastric lavages, liver extract, and vitamin B concentrate, improvement was slow. This man was surveyed for limited duty ashore.

Case 3.—A steward's mate, first class, 32 years of age, had a partial gastrectomy for penetrating duodenal ulcer and was found to have a moderate gastritis about the stoma without symptoms. Five months after surgery the same findings were demonstrated even though the patient was symptom free, following an ambulatory ulcer regimen with abstinence from smoking and drinking.

Case 4.—A Veterans' Administration patient, 64 years of age, had had a gastro-enterostomy performed in 1938. At the time of admission he complained of severe epigastric pain and vomiting. He had been having mild pain to the left of the umbilicus for the last three years. The symptoms suggested a perforating gastrojejunal ulcer. Gastroscoy showed diffuse redness of the stomach with edema and exudation of the mucosa near the stoma. No ulceration was seen. Response to medical management was satisfactory and he was discharged as symptom free.

Case 5.—Gastro-enterostomy was performed for duodenal ulcer with partial obstruction in one patient, aged 39. Two months after surgery considerable edema and inflammation was present about the operative stoma. One month later the inflammatory reaction was gone and he felt well. This man was surveyed to limited shore duty.

Because of the frequent findings of gastritis in postoperative stomachs we have been very conservative in this hospital in recommending resection or any type of surgery in the management of duodenal ulcer. Four patients were operated on during the past year because of complications of duodenal ulcer.

Negative gastroscopic findings.—Gastroscopic examination findings were normal in 77 or approximately one-half of our total series. Fourteen of this group were transferred to the neuropsychiatric department because of psychoneurosis. Seventeen were invalidated from the service because of duodenal ulcer and other extra-gastric conditions.

The remaining 41 patients were considered to have their symptoms arising from dietary indiscretions, faulty eating habits, missing teeth, achlorhydria, and so forth. These men were treated, advised accordingly and returned to duty.

COMMENT

In the diagnosis of disturbances of the gastro-intestinal tract there is no substitute for a well taken history and a careful physical examination. When the usual aids are utilized, a definite diagnosis can be made in a large percentage of cases, or at least the process may be localized as in the stomach or duodenum.

Although the x-ray is still the *sine qua non* in the diagnosis of lesions in the stomach and duodenum, the gastroscope is proving itself to be an invaluable supplementary aid. The diagnosis of inflammatory lesions of the stomach is entirely dependent upon gastroscopic observation. Our experience both in the Navy and in civilian practice has also indicated that gastric ulcerations are not infrequently seen by gastroscopy when the x-ray findings are negative. The converse is also true, so that the total number of gastric ulcerations found is increased when both methods are used. The differentiation between malignant and benign ulcerations is greatly facilitated, particularly when observations are continued over a

period of time. If the lesion appears to be malignant, there should be prompt surgical intervention.

Response to treatment in cases of chronic superficial gastritis has been good. When the condition was of less than one year's duration, the symptomatic response was prompt and the gastric mucosa later became normal. These men were then able to eat regular food and were returned to duty. In cases of hypertrophic gastritis improvement took place, but periods of distress occurred and the gastroscopic picture remained unchanged. It is also significant that gross gastro-intestinal hemorrhage commonly occurs in such cases. The common occurrence of this complication, in addition to the usual poor response to treatment, leads one to conclude that the likelihood of such patients being able to continue their duties at sea is questionable.

One of the most satisfying aspects of gastroscopy has been the material aid that it has given in separating those patients with organic lesions from those with functional disturbances of the gastro-intestinal tract. When the latter group showed no other abnormalities, they were promptly returned to duty.

The frequent finding of gastritis and marginal ulceration in the stomach after operation as the only explanation of distress demands adherence to a medical regimen to prevent or to minimize this complication. It has been our experience that an unrestricted dietary regimen together with the exigencies of duty aboard a combat ship will easily lead to postoperative complications. We have, therefore, not viewed with any degree of optimism the performing of radical surgical operations for peptic ulcer (particularly duodenal) on Navy personnel with the idea that they will be fit for unlimited duty. Three such patients who were operated upon in another Naval hospital were recently seen because of a return of stomach symptoms. They were recommended by the board of medical survey for limited duty ashore. When these patients are so surveyed it is important that they have proper dietary facilities available. If these are not available the purpose of the disposition will be defeated.

SUMMARY

1. The results of a clinical and gastroscopic study of selected cases of upper abdominal distress observed in a Naval hospital are presented.
2. The disposition of the cases studied is given.
3. Gastroscopy is considered invaluable in the differential diagnosis, evaluation, and management of cases of gastric disease.

EFFECTIVE MANAGEMENT OF GASTRO-INTESTINAL DEPARTMENT AT NAVAL HOSPITALS

HENRY A. MONAT
Commander (MC) U.S.N.R.

and
WILLIAM T. CARLETON
Lieutenant Commander (MC) U.S.N.R.

The purpose of this paper is to systematize the work of the gastro-intestinal department so that a minimum of delay in treating and a rapid disposition of the patient can be made.

In order to have the treatment most effective a well equipped ward must be set aside for gastro-intestinal work. It should be cheerful, sunny, well ventilated with quiet rooms and an examining room which can be darkened. Ideally the physical and diagnostic equipment of the treatment room would consist of a tub for hydrotherapy; a sitz-bath basin; a proctoscopic table which also can be used as a gastrosopic table; proctoscopic set; gastroscope; scale; diagnostic ear, nose and throat instruments; hammer; tuning fork; eye chart; illustrative charts showing normal and diseased gastro-intestinal tracts; a large basin with a suction and flushing attachment for proctoscopic examination; a sterilizer; jars with lubricating jelly; rectal anesthetic ointments; finger cots; gauze sponges; cleaning tissue, and long cotton applicators. The ward in addition to its normal physical equipment should have a massage table, basins, 5-ounce wide-mouth bottles for gastric analysis and duodenal drainage, rubber sheets, 2-quart enema cans, and paper containers for formed stools.

The following routine is suggested upon admission of the patient to the ward: A complete history should be taken and physical examination made as quickly as possible. Patients with very few symptoms, and those who are under observation, may remain ambulatory whereas the ones with pronounced symptoms should be strictly bed patients. All patients on admission are told that during the following 2 weeks of observation and treatment or until such time as all their studies are completed, there will be no liberty privileges.

All patients arriving with symptoms of gastro-intestinal irritation are placed on a diet which is free of meat, fish, and leafy vegetables (for occult blood studies). Upon admission, patients with jaundice or cirrhosis of the liver are placed on a diet of low fat, high carbohydrate and high vegetable protein. All patients who suffer from symptoms of acute or chronic gastritis, such as bleeding or vomiting, or who are in a state of malnutrition, in addition to the

admission diets should receive 25 mg. of thiamine chloride daily, 2 units of crude liver three times a week parenterally and 1 pint of orange juice per day.

All men on admission receive routinely a sedative antispasmodic rectal suppository upon retiring. This consists of barbital and atropine, and in case of severe pain, codeine is added. They receive the suppository for 7 successive nights. Especially agitated patients receive massages daily and a 1-hour, lukewarm, alkaline, relaxing bath in the evening. The following morning, before breakfast, a gastric analysis and duodenal drainage are performed. In order to relieve laboratory load, the gastric analysis technic is simplified and is performed on the ward.

Following is the description of the technic: The fasting stomach is emptied; the amount of secretion, the quantity of mucus, microscopic blood, and pH is estimated by the simplified LaMotte technic. If the amount of secretion shows nothing abnormal, does not exceed 1½ ounces and shows normal acidity, any further study of the gastric analysis becomes unnecessary. In case there is an abnormal amount of secretion, an excessive amount of mucus, or the pH is below normal limits, it is obvious that there is some gastro-intestinal irritation and further stimulation of the gastric mucosa is unnecessary. In case the fasting stomach sample shows either increased secretions with hypoacidity, or normal amount of secretion with anacidity or hypoacidity, then 10 cc. of beef juice (5 cc. juice to 5 cc. of water) are injected. After 15 minutes the sample is tested for pH value. If the sample still shows anacidity then histamine is given parenterally. After 30 minutes the sample is withdrawn and the pH estimated.

After completing the gastric analysis the duodenal drainage is performed, using wide-mouth glass bottles for the sequence of the bile change. The bile samples are immediately examined for cholesterol crystals. The test is performed by the corpsmen who are trained accordingly and who make notations of the procedure.

At the end of 4 days when the patient has finished the diet for occult blood, a stool is collected and sent to the laboratory for microscopic studies and occult blood estimation. The Gregerson test for occult blood is used which is very simple, saves a great deal of time, is more accurate than others and has less false positives.

The patient is then placed on a diet which consists of nonirritating foods in a puréed form. Beef, tea, coffee, sugar, fried foods, spices, meats and poultry rich in fat content, such as pork and goose, are eliminated from that diet as are raw vegetables. Honey and corn syrup are substituted for sugar.

For the period of hospitalization the patient remains on this diet,

with the exception that underweight patients receive added calories in the form of butter, cream and eggs, while the overweight patients receive the low-caloric equivalent of this diet. All patients with gastro-intestinal irritation receive intermittent feedings at 10, 3 and 10, consisting of milk, chocolate milk and eggnogs, the underweight patient receiving the choice of the latter two. The chocolate milk is prepared with very little chocolate and sweetened by corn syrup—it is not very sweet and not conducive to gastric fermentation.

Management of pain and reducing acidity.—Patients are instructed to sip their milk slowly between meals and whenever they have any abdominal discomfort. (No cold liquids should be given.) If this still does not alleviate the pain, they are free to use cremalin which is at their disposal on the ward. If the pain is not then alleviated they receive hot wet packs to the abdomen with a heat cradle over them. In addition 1/100 grain atropine may be given hypodermically. These patients have their stomachs washed out with a warm cremalin solution at midnight and again in the morning.

All patients with jaundice receive gallbladder drainage daily; also 6 vitamin-K capsules per day with short-wave diathermy to the liver. All ulcerative colitis patients should receive bed rest for 1 month and nourishment at exactly the same time every day. Fresh milk should be avoided and only powdered milk used. These patients also receive 6 capsules of vitamin K and, depending upon their condition, frequent small transfusions, thiamine and liver parenterally and multiple vitamins by mouth.

All patients with diarrhea must send their stool specimens for parasitic study for 5 successive days. These are taken in glass containers, placed in warm water and sent immediately to the laboratory.

All patients with gastro-intestinal conditions are forbidden to smoke and they are informed that to be caught smoking is "willful misconduct" interfering with and obstructing treatment. This is a measure of extreme importance in the handling of these patients, for if a patient stays on the strict regimen outlined he cannot possibly fail to improve unless he smokes or has a severe emotional conflict. In patients with organic disease who do not improve, who continue to complain, it is usually found that they have broken the cigarette ban, however few the occasions. These patients are of a nervous disposition and often smoke heavily. They find it difficult to stop and will not unless disciplinary measures are used or at least threatened.

Laxatives are not prescribed at all on the gastro-intestinal ward. The patient is instructed in proper bowel movement and rectal

hygiene. Occasionally a 6-ounce warm starch enema has to be given to patients who have fecal impaction.

It is suggested that an average stay for a proved peptic ulcer patient should not exceed 6 weeks. At the end of that time, the man should be surveyed either out of the service or to limited shore duty. The great frequency with which ulcer patients have recurrence of symptoms while at sea, with increased physical and emotional stress, on regulation mess, makes it unwise to return these men to duty.

A majority of the patients on this service exhibit emotional instability and nervousness and their gastro-intestinal symptoms are expressions of increased autonomic tension or constitutional inadequacy. The symptoms are real and are caused by cardio-spasm, pylorospasm or irritable colon.

Patients with early ulcerative colitis should remain in the hospital at least 2 or 3 months; those in an advanced condition after an adequate period of medical management, not exceeding 1 to 2 months, should be transferred to the surgical ward.

Average patients under observation do not have to be hospitalized longer than 10 days.

Radiographic studies of the patient should consist of both gall-bladder and complete gastro-intestinal series, in some cases including barium enema. Such studies, however, should never be undertaken prior to complete relaxation of the patient. It is suggested for the ease of managing the ward, that x-rays should be taken on specified days, preferably twice a week.

Gastrosopic studies should also be undertaken after the patient is completely relaxed; that means about a week after his admission and a special day should be set aside for these studies. Proctoscopic and sigmoidoscopic examinations should be set for a specified hour, preferably early afternoon after the patient has received appropriate enema.

The chaplain and social service workers should be informed of the emotionally disturbed patients and those with domestic difficulties so that effective sociologic and spiritual aid may be rendered.

In conclusion, it is very important that the personnel of the gastro-intestinal wards should be well trained and have an understanding of the mental and physical stress and strain of gastro-intestinal patients. To cater to the gastro-intestinal patient requires a tremendous amount of tact and patience as the borderline between the functional and organic disturbance is so narrow that only a thorough investigation and sympathetic handling can unravel the psychosomatic or organic entanglement.

PASSAGE OF MILLER-ABBOTT TUBE THROUGH PYLORUS WITH AID OF ELECTROMAGNET

HENRY MAYER, JR.
Lieutenant (MC) U.S.N.R.

The Miller-Abbott tube has proved itself an ideal means of decompressing the bowel in cases of intestinal obstruction and is now widely used for preoperative decompression, postoperative mechanical obstruction and for prevention and treatment of paralytic ileus. The rationale and indications for its use have been discussed in numerous publications, but it has not been as widely used as it should be because of the difficulty and delay in getting the tip past the pylorus. This difficulty has, at times, been the cause of long and costly delays in urgently needed relief of intestinal distention, which is obviously detrimental, but should not be allowed to overshadow the extreme usefulness of the tube.

Wangensteen (1) claims fair results with the original method of introducing the catheter through the nares and evacuating the contents of the stomach by suction. Following this the patient is turned on his right side and the catheter advanced 2 or 3 cm. every 5 minutes, during which time sips of water can be administered. The process can be hastened and more successfully handled under the fluoroscope. When the tip has finally passed the pylorus and is well into the duodenum, the balloon is inflated with 30 cc. of air. The tube then progresses rapidly to the point of obstruction, deflating the small bowel as it proceeds. This method is fairly successful but difficult, involves constant and prolonged attention and is very slow.

An adaptation of this method was developed by Doss (2) in 1938 when he attached a lead shot 6/10-inch long to the tip of the tube as a leader. Smith (3) in 1941 and Morton (4) in 1943 repeated this technic with considerable success. The method is simpler and surer than the original, but it is still frequently unwieldy and slow. Miller and Abbott (5) suggest that should the preceding method fail, the stomach be emptied of gas and filled with fluid. The balloon is then filled with air and the patient placed on his left side in an attempt to float the balloon through the pylorus. This is only a moderately successful method.

In 1941 Hay (6) suggested the use, under the fluoroscope, of a flexible adjustable cylindrical tube whose tip is placed near the pylorus. The Miller-Abbott tube is then passed through the tube into the pyloric canal.

Hamrick (7) in a recent article gives a very ingenious method for determining, without the use of the x-ray, when the tube has reached the cardia and pylorus. This is done by inserting the tube into the stomach, blowing up the balloon and withdrawing it until it is stopped by the cardia. The balloon is then deflated and the tube advanced approximately the length of the stomach toward the pylorus. If it is again attempted to blow up the balloon there will be no back pressure if it is still in the stomach proper. However if it has entered the pylorus there will be considerable resistance, which will again disappear when the tube has progressed into the duodenum. The method of passing the tube is, however, still fundamentally the same as the original method of Miller and Abbott.

As long ago as 1933 Paine (8) suggested (without clinical trial) the use of an electromagnet as an aid in passing the tube. Gius in 1941 made some preliminary trials with a tube mounted with a suitable magnetic bucket and suggested the possibility of directing the tube into the duodenum. He mentioned this in a personal communication to Wangenstein, but the author can find no article in the literature describing his work.

The problem, therefore, of finding a simple rapid method of passing the Miller-Abbott tube through the pylorus faced the author on numerous occasions. Two years ago an attempt was made with Dr. Carl Roessel to pass the tube with the aid of a magnet, the project was unsuccessful and the idea was temporarily dropped. Recently, however, having occasion to pass a Miller-Abbott tube, the author again attempted to use a magnet.

It was desired to make the tip of the tube of a highly magnetic material which would be relatively noncorrosive. Alnico, a permanent magnetic alloy, was found to satisfy the requirements. The only drawback to its use was the difficulty of fabricating it into the desired shape. Alnico is not machinable, and although the outer surface of the tip can be ground, the hole through the center can be obtained only by casting. If manufactured, therefore, the metallic tips will have to be specially made by casting in high temperature furnaces.

A substitute for Alnico which is not as good, but which was used for some time with success until Alnico was obtained, is a 12-2, stainless steel, type 414.

The metallic tip is fixed on the end of an ordinary Miller-Abbott tube. This is used in conjunction with a good hand type of electromagnet, the type used in extracting metallic foreign bodies from the eye. With heavier patients, where the distance between the magnet and the tip is necessarily greater, a more powerful magnet may be necessary. In all cases, however, where Alnico is used the

polarity of the tip of the tube must be determined with relation to the magnet, the latter being adjusted so that it attracts rather than repels the metallic tip. This can easily be tested prior to introduction of the tube and if the tip is repelled by the electromagnet, the polarity of the latter can be reversed by reversing the plug in the socket.

Once this has been determined, the tube is passed through the nares into the stomach in the usual manner. After a short period of decompressing the stomach by attaching a Wangensteen suction apparatus, the tube is passed down (preferably under a fluoroscope until the technic is mastered) to the pylorus. Occasionally the tube will tend to loop back in the stomach and the magnet in these cases can be applied under fluoroscopic control along the anterior abdominal wall in such a way as to guide the tip toward the pyloric antrum. The pull of the magnet, however, is merely a guide and is not sufficiently strong to pull the tube without the aid of feeding from above.

Once the tip has reached the pylorus, the patient is turned to the right anterior oblique position (either erect or prone) and the magnet applied firmly against the right flank posteriorly in line with the general direction of the first portion of the duodenum and at the same level as the tip of the tube as visualized under the fluoroscope. The power is then turned on and the tube slowly but steadily advanced from above. It will be seen under the fluoroscope to pass quite readily through the pylorus into the first portion of the duodenum. The magnet is then removed, the tube advanced and the balloon inflated in the usual manner. The ease and speed of this procedure provide advantages which are at once apparent to any one who has attempted to pass a Miller-Abbott tube.

The electromagnet will not interfere with the use of the fluoroscope. It is important, however, to remove all watches from the vicinity of the electromagnet prior to use in order to avoid magnetizing them.

This is a preliminary report on a small number of cases. The results however, are promising in that the tube can usually be passed through the pylorus within one or two minutes, and in no case attempted thus far has it failed. In two of the cases another physician had tried twice within a period of 24 hours to pass the tube without success.

It is hoped therefore that this will offer a simple and sure means to overcome the one drawback of a Miller-Abbott tube, namely the difficulty and delay in its passage through the pylorus. It also should be of use in passing a duodenal tube for diagnostic and therapeutic purposes. It may with further experience enable us to pass

the tube at the bedside without the necessity of subjecting a sick patient to a prolonged and tiring session under the fluoroscope or x-ray machine.

Since this article was submitted the author has learned of a new alloy many times as magnetic as Alnico which offers great possibilities in this field, but has not as yet been obtainable.

REFERENCES

1. WANGENSTEEN, O. H.: *Intestinal Obstruction: A Physiological and Clinical Consideration with Emphasis on Therapy, Including Description of Operative Procedures*. 2d edition. Charles C Thomas, Springfield, Ill., 1942.
2. DOSS: Quoted by Wangensteen.
3. SMITH, B. A.: *Gastro-intestinal suction tubes; their efficacy in decompressing stomach and bowel*. M.S. Thesis, University of Minnesota, 1941.
4. MORTON, H. B.: Improved tip for Miller-Abbott tube. *Ann. Surg.* 117: 159-160, January 1943.
5. MILLER, T. G., and ABBOTT, W. O.: Intestinal intubation: practical technic. *Am. J. M. Sc.* 187: 595-599, May 1934.
6. HAY: Quoted by Wangensteen.
7. HAMRICK, W. H.: Technic for introducing Miller-Abbott tube. *U. S. Nav. M. Bull.* 41: 1737-1742, November 1943.
8. PAINE: Quoted by Wangensteen.



CARDIOSPASM

Cardiospasm is, in most cases, a psychosomatic disease. Organic disease of the vagus nerve and reflex causes are also of etiologic significance. It is not a spasm but an achalasia (failure actively to open). The dilatation persists despite clinical improvement. Elongation, esophagitis and diverticula may develop.

Esophagoscopy is imperative to exclude neoplasm and peptic esophagitis. Psychotherapy and the soft mercury-weighted rubber esophageal bougie are the two best forms of therapy for the patients with a straight, dilated esophagus. For patients with an elongated, figure-of-S esophagus, esophagogastrostomy is indicated. Artificial hyperpyrexia deserves further study as a therapeutic agent.—WINKELSTEIN, A.: Some general observations on cardiospasm. *M. Clin. North America* 28: 589-592, May 1944.

FRACTURES OF THE CARPAL NAVICULAR

HERBERT E. HIPPS

Lieutenant Commander (MC) U.S.N.R.

This analysis of 37 consecutive fractures of the carpal navicular has yielded some interesting data which may help to dispel certain current misconceptions about navicular fractures. These all occurred in young men who were admitted to a Naval hospital. In 36 cases (97 percent) the injury occurred as a result of a fall on the outstretched and abducted arm so that the force of the fall came on the thenar eminence. In all but two of these patients (94 percent) the fracture occurred transversely across the narrow "waist" of the bone. One patient had both naviculars fractured.



1. Navicular after 4 weeks showing well developed fracture line due to absorption and early marginal sclerosis.

Diagnosis of fresh fractures.—There is the history of a fall on the outstretched arm, pain with motion of the wrist, most noticeable when the thumb is moved, and tenderness and often swelling over the navicular just proximal to the base of the thumb metacarpal. Passive movement of the thumb and forefinger, particularly backward pressure along their longitudinal axes, exaggerates the pain.

X-ray examination will show the fracture if the proper technic is used in making the picture. An ordinary flat hand anteroposterior and lateral film often fails to show the break, but should, of course be made to rule out other wrist pathologic changes. If these pictures fail to demonstrate a fracture line and tenderness persists on motion at the end of 3 weeks, a subsequent x-ray will usually demonstrate a fracture if it is there, since enough absorption will have occurred along the fracture line to make it clearly discernible (fig. 1). If a bony defect is not visible on the film at this time, it may be concluded that no fracture occurred.

Treatment of fresh fractures.—A nonpadded plaster of paris splint is applied to the dorsum of the hand and forearm and is wrapped in place with a 2-inch gauze bandage. No padding or stockinet is used. Then 4-inch circular plasters encircle the arm and hand to make a complete cast as shown in figure 2. The hand is slightly dorsiflexed and in neutral position as far as radial and ulnar deviation is concerned. If the hand is in ulnar deviation the fracture line may be spread apart; if in radial deviation the fragments may slide sideways on each other to a minute degree and thus cause roughening of the joint surface as healing occurs. The plaster must extend through the space between thumb and forefinger.



2. Immobilizing cast as used in both fresh and old navicular fractures.

The use of a sling is discouraged and the patient is urged to use his hand freely in every possible way, as long as he does not soften or break the plaster. Immobilization of the wrist must be

as nearly complete as possible and must be continuous and uninterrupted. Finger motion is however not limited in any way.

Ninety days or more are usually necessary for firm union to occur. In this series of 23 consecutive fresh fractures the average time was 87 days.

When the cast is removed and firm union is present there should be a minimum degree of pain and stiffness; the patient will say that the wrist feels strong and an x-ray should reveal good union. Such a patient will be ready for full military duty in 5 or 6 more days. When soreness of any appreciable degree is present, the wrist feels weak, or the x-ray shows meager callus formation, the arm is again placed in a cast for an additional month.

It is not essential for the old fracture line to be obliterated completely in the x-ray picture; this may not occur for another 3 or 4 months. However it must be determined that there is adequate callus formation and that good clinical union is present before permitting return to full duty. It is always wise to err on the side of prolonged immobilization rather than to return the patient to duty before solid union has occurred. Immobilization in this way does not decalcify the wrist bones, because the patient is using the hand and fingers constantly. Muscle weakness and atrophy do not occur with this type of fixation.

TABLE 1.—*Fresh navicular fractures*

Case No.	Type of cast	Cast on, days	Union	Duty in days	Result	Remarks
1	Nonpadded	88	yes	4	good	
2	do	30	no	15	poor	Remaining pain and stiffness.
3	None		do		do	Very sore wrist.
4	Nonpadded	90	yes	4	fair	Slight pain with heavy activity.
5	do	67	do	9	good	
6	do	69	do	4	do	
7	do	96	do	7	do	
8	do	69	do	7	do	
9	do	64	do	3	do	Atypical fracture.
10	do	108	do	5	do	
11	do	95	do	5	do	
12	do	90	do	6	do	
13	do	86	do	5	do	
14	do	66	do	7	do	Atypical fracture.
15	do	96	do	5	do	
16	do	96	do	6	do	
17	do	73	do	5	do	
18	do	88	do	4	do	
19	do	90	do	2	do	
20	do	94	do	3	do	
21	do	90	do	4	do	
22	do	88	do	5	do	
23	do	89	do	3	do	
24	do	120	do	4	do	
25	Padded	60	no		poor	Pain and stiffness.
26	Nonpadded	82	yes	6	good	Associate fracture, head of radius.

In table 1 is summarized a series of 26 fresh navicular fractures. It is noted that a nonunion occurred in one patient because of a too short period of immobilization and in another because of no immobilization. In a third case nonunion occurred as a result

of a too short period of immobilization with a padded cast allowing motion in the wrist. The patient stated that the cast felt loose on the wrist soon after its application. It had been applied over stockinet and sheetwadding with felt padding over the bony prominences of the wrist. In a fourth case, although firm union occurred, some pain remained with prolonged heavy activity, probably due to a slight malposition.

Nonunion has not occurred in any case that has been treated by the method previously outlined. Firm union can be expected in all simple navicular fractures with treatment as described if fixation is maintained for a sufficient period of time.

Nonunions of carpal navicular.—The 11 patients listed in table 2 entered the hospital with a diagnosis of nonunion, or this diagnosis was established soon after admission. The duration of the nonunion, in so far as could be determined, varied from several months to five years.

TABLE 2.—*Navicular nonunions*

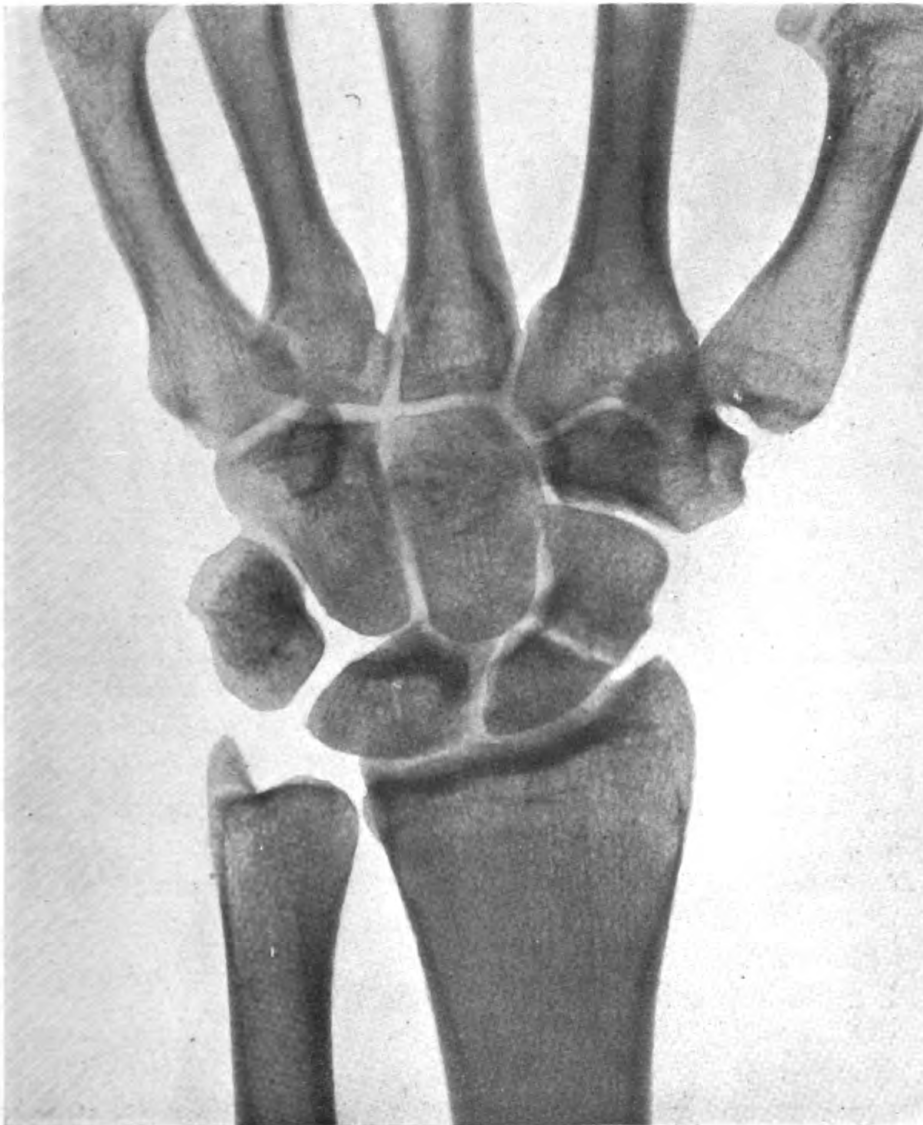
Case No.	Duration before	X-ray findings	Treatment	Union	Days for union	Result	Remarks
1	8 months	Sclerosis and absorption . . .	Nonpadded cast	yes	127	good	Figure 3. Figure 4. Mild pain with heavy exertion. Traumatic arthritis.
2	3 months	Absorption only	do	do	116	no follow up	
3	18 months	Proximal segment avascular. Absorption and sclerosis . .	do	do	130	good	
4	3 years	Considerable sclerosis and absorption	Drilling oper. Bone graft	do	126	do	
5	2 years	Proximal fragment avascular. Absorption and sclerosis . .	do	do	128	do	
6	5 years	Much cavitation. Sclerosis and absorption. Proximal segment avascular	Nonpadded cast	no	90	poor	
7	2 years	Moderate sclerosis and absorption	Bone graft	yes	171	good	
8	4 months	Slight absorption	Nonpadded cast	do	91	do	
9	5 years	Much cavitation. Sclerosis and absorption. Proximal segment avascular	Bone graft	do	109	fair	
10	6 years	Absorption with much sclerosis and cavitation	3-month rest in hospital	no	94	poor	
11	6 months	Mild sclerosis. Moderate absorption	Nonpadded cast	yes	98	good	

Symptoms.—All of these patients with nonunion of the navicular bone evidenced symptoms of pain, soreness and weakness in the wrist. In every case the disability was aggravated by the heavy activity incident to Naval service. One patient whose original injury occurred one year before entering the Navy had complained only of weakness in his wrist; but on beginning active "push-up" exercises as a cadet, he developed a painful wrist, with which he was admitted to the hospital.

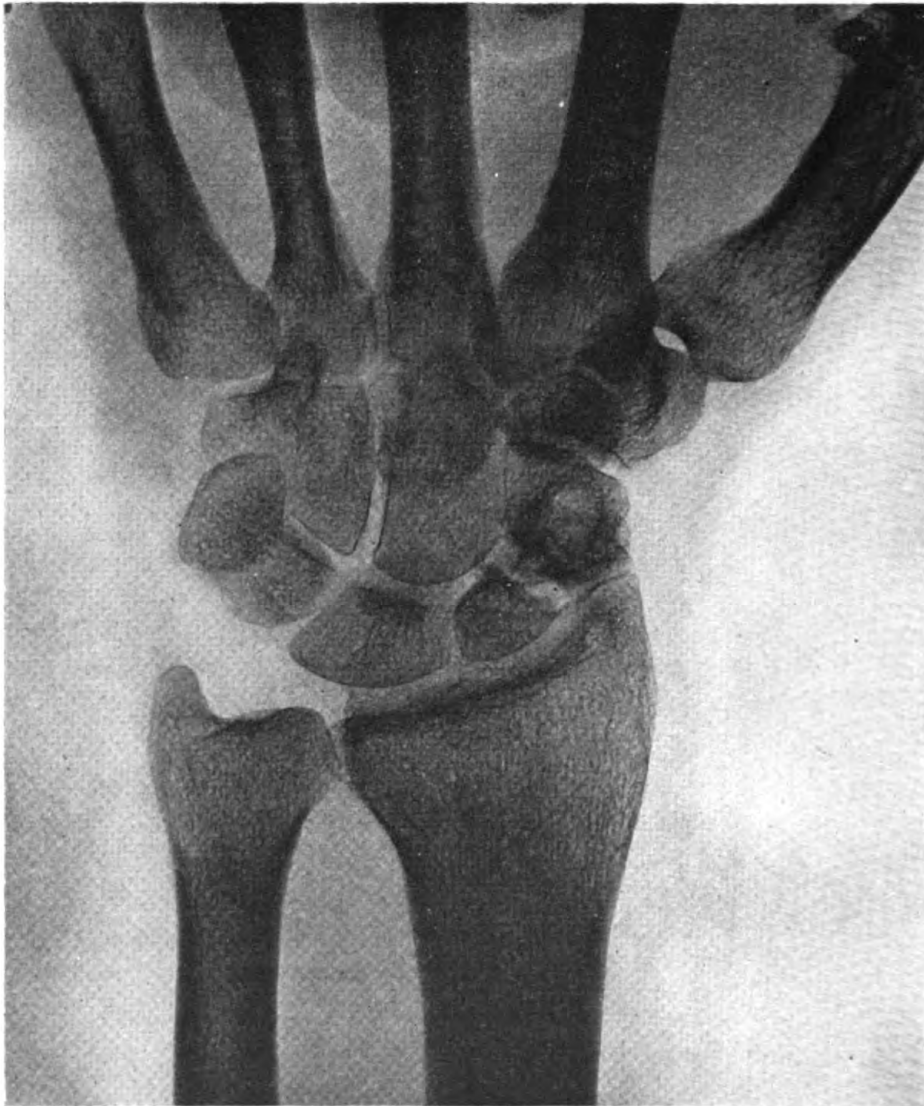
Physical findings.—The most constant finding was tenderness over the navicular on pressure. In some patients there was limitation of wrist motion and some pain with motion, but often pain

occurred only on passively deviating the wrist in a radial and dorsal direction. Slight swelling was occasionally noted over the radial side of the wrist.

X-ray appearance.—The fracture line is very clearly seen in every case of nonunion. It has become prominent because of absorption of the bone immediately adjacent to the break. This zone of marginal absorption is often visible on only one fragment (fig. 3). In early nonunion this may be the only finding, but in a later stage sclerosis about the fracture margins has begun and either simultaneously or later cavitation will occur. This latter more often occurs in the bone adjacent to the fracture line, but in ad-



3. Nonunion showing absorption occurring in distal fragment and none from proximal fragment. Proximal fragment is more dense than distal fragment. Sclerosis is occurring about absorption zone of distal fragment



4. Nonunion showing wide fracture line. Sclerosis is present and cavitation is visible in distal fragment. Note increased density of proximal fragment.

vanced stages it may be visible farther away from that margin (fig. 4).

Results of treatment.—The following three methods of treatment have been successfully used in obtaining a satisfactory result in every case of nonunion treated.

1. Simple immobilization (prolonged).
2. Drilling the fragments.
3. Bone graft.

There was one patient with a nonunion of 8-month duration. Treatment consisted of a nonpadded cast applied exactly as has been described for a fresh fracture. It was worn for 127 days and on removal there was a strong union.

Union could be expected to occur in this fracture with simple immobilization, if the x-ray shows that the two fragments are of the same density, indicating a blood supply to both sides. Absorption and sclerosis occurring on both sides of the fracture line is a further indication that both fragments have an intact blood supply. Union should occur if the bone is immobilized allowing blood vessels and osteoblasts to grow from one bone to the other without being repeatedly interrupted by motion.

In another patient with a well defined nonunion, a nonpadded cast was worn for 90 days with the result as noted in figure 4. A review of this x-ray notes the following significant facts: (1) There is a wide fracture line which would make it difficult for blood vessels to cross over from one side to the other. (2) There is marked



5. Showing bone peg through both fragments. Solid union is present. Cavitation and sclerosis have disappeared and both fragments now are of same density.

sclerosis and cavitation of the distal fragment indicating an adequate blood supply, whereas the proximal fragment presents no cavitation, no sclerosis, no absorption and a general increased density as compared with the distal fragment, indicating an insufficient blood supply.

Therefore there is a live vascular bone trying to grow to a dead nonvascularized bone, an important factor in determining whether simple immobilization alone will cause union to occur. Furthermore, in this case the excessive marginal sclerosis more than ever makes union improbable. Taking all these factors into consideration it is not difficult to see why union did not and could not occur.

Figure 5 shows the firm union obtained in this same case 109 days after a bone graft-drilling operation. The wrist was opened over the navicular. The fracture line could be visualized by pressing upward on the bone from the palmar aspect while deviating the



6. Showing good union with bone graft in place.

hand in a palmar and ulnar direction. The bone was found exactly as visualized by the x-ray. The distal fragment was soft except for the sclerotic zones. The proximal fragment was hard, the hyaline cartilage lining this segment being darker in color and less glistening than that over the distal.

There was a flat layer of grayish white fibrous tissue lying between these fragments but it was largely adherent to the vascular distal fragment. This layer was removed, the bone was freshened and a small cortical bone peg from the tibia was placed through the two fragments and across the fracture line. Multiple drill holes were then placed through both fragments, and the bone meal coming out along the drill in making the drill holes was packed into the fracture space where the fragments would not accurately or closely coapt. A padded cast was worn for 10 days; the stitches were removed and a nonpadded cast was then applied.

Bone grafting was done on the case shown in figure 3. The result is seen in figure 6, 128 days after operation.

One patient was treated by simple drill holes placed through both fragments and across the fracture line. The incision over the navicular was short and only exposed the surface of the proximal fragment. A nonpadded cast was applied after removal of the stitches in 10 days. It is possible that union would have occurred in this patient with immobilization alone, but it was thought better to do the drilling operation because of the amount of marginal sclerosis. Sufficient healing had occurred in 126 days, so that the patient had a strong painless wrist and was sent to duty with instructions to be careful with the wrist for another month.

Choice of operation.—One must keep in mind the conditions necessary for union to occur in any fracture. There must be fresh bone surfaces that are in close contact and they must be kept immobile. Thus the operative procedure of choice will endeavor to satisfy these conditions as accurately as possible.

Marginal sclerosis usually indicates an avascular fracture surface; hence this surface must be freshened to permit outgrowth of the fibro-vascular network from one fragment to the other. Multiple drill holes across the fracture line usually make this possible.

If a fracture line is wide it becomes very difficult for blood vessels to grow across from one side to the other; furthermore complete and accurate contact of fragment to fragment is impossible. It is in such a condition therefore that a bone graft becomes necessary. The bone peg accurately immobilizes the fracture and the bone meal inserted into noncoaptating areas furnishes a skeletal support for growth of this early vascular tissue.

Before an avascular segment can unite to the other one, it too

must become revascularized. The process of "creeping substitution" by which this occurs is greatly hastened by multiple drill holes into the avascular bone.

In summary, prolonged immobilization with a nonpadded cast will usually induce union when:

1. The fracture line is not wide.
2. There is a blood supply to both fragments.
3. There is very little marginal sclerosis.

The multiple drilling operation followed by prolonged fixation is indicated when:

1. The fracture line is not wide.
2. Marginal sclerosis is present.
3. One fragment is avascular.

The bone graft operation (plus prolonged fixation) becomes necessary when there is a wide fracture line.

In doing this bone graft operation one should not be content to insert a bone peg and close the wound. The peg has no osteogenetic properties whatever, serving only as a very efficient immobilizing agent. Additional drill holes should be made through both fragments and where possible the fracture line should be exposed, freshened and drill hole meal packed into zones not closely coaptating. Union will occur in an extremely high percentage of these cases.

CONCLUSIONS

1. Fresh fractures of the carpal navicular will always heal with proper treatment.

2. Complete healing of fresh fractures usually occurs in 12 weeks and seldom occurs before that much time has elapsed.

3. Any "sprained" wrist remaining sore longer than 3 weeks should be re-x-rayed, since navicular fractures sometimes fail to show up in the first x-ray.

4. Nonunion of a fractured navicular always produces symptoms upon heavy activity.

5. In any nonunion of a carpal navicular strong firm union can be induced with proper treatment in an extremely high percentage of cases.

SKELETAL TRACTION IN FRACTURES OF HAND AND WRIST

WALTER W. EBELING

Lieutenant Commander (MC) U.S.N.R.

Numerous methods for the application of traction to the fingers and hand have been described from time to time in the medical literature. As a consequence there are today various pieces of apparatus available to anyone who wishes to invest a considerable sum in equipment and accessories. Some of the more complicated of these mechanical contrivances have almost as many accessories as there are bones in the body, and are accompanied by "technic books" describing in some detail the use of each piece, and its adaptability to the various parts of the skeletal structure. Other methods have been described which are simple and require no more special equipment than the one about to be presented, yet have minor objectionable features which will be considered as this procedure is outlined.

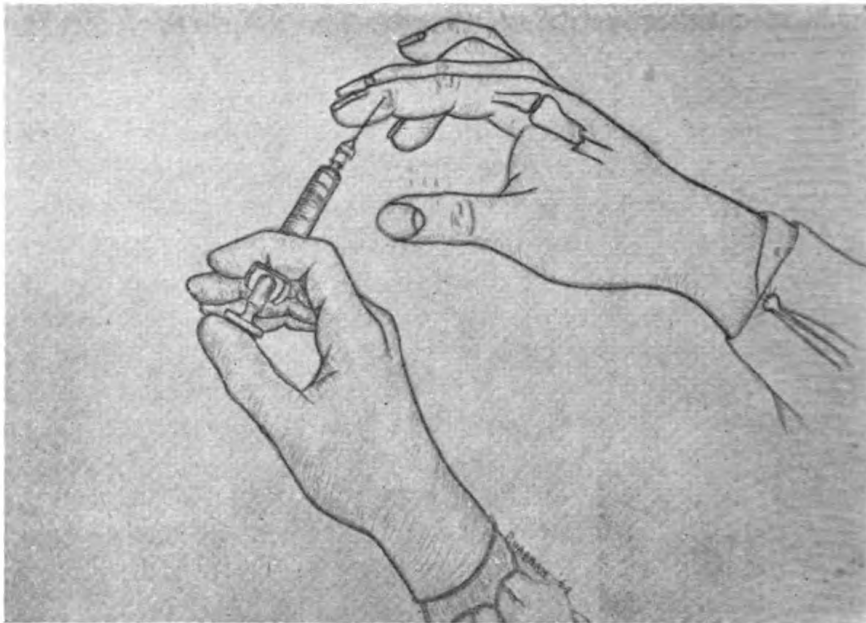
In spite of a considerable experience with one of the more technical and complicated pieces of apparatus for the application of skeletal traction to fractures of the hand and wrist, the writer has by choice elected to use it less often than he has the method to be described.

The efficient and proper use of many of these complicated appliances presupposes a detailed knowledge of mechanics and surgical anatomy. Numerous breaks in asepsis have resulted in infections. This has occurred not so much through lack of knowledge of the principles of surgical asepsis, as through an utter exhaustion when it became necessary to "gather up" the pieces of equipment needed to apply an apparatus. This in turn has caused a lengthy operative procedure, long anesthesia, frequent x-ray exposures and frequently has resulted in failure to obtain suitable results.

There are types of fractures of the hand and wrist, which, when reduced, do not maintain their reduction by ordinary splinting with wood or plaster. Many of these are of the "inclined plane" type, those in which the fragments actually slide off one another as soon as the anesthesia has worn off and the muscle pull has been restored. Others may be comminuted, compounded, or both, and by their location alone may be difficult to splint after reduction. This is particularly true of fractures of the metacarpals and phalanges. Experience has shown that most of the fractures of the upper ex-

tremity require only a dorsal, ventral and an occasional lateral splint to maintain their position after reduction. Skeletal traction may provide the answer to those fractures in which the simple splint fails.

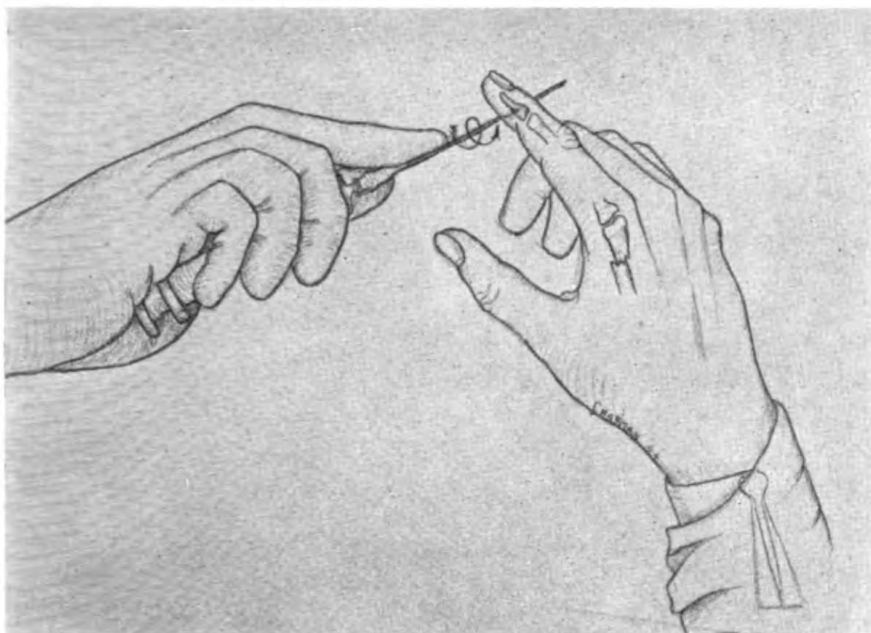
The desirable method of skeletal traction to adopt would be one which is direct in its application, which can be used with ease and simplicity, is neither time consuming nor requires a great deal of anesthesia, uses the usual materials at hand, requires a minimum of effort to obtain satisfactory results, and is practically without danger to the patient.



1. A wheal of novocain solution is made on each side of the finger.

Description of procedure.—1. Fingers and hand are prepared for surgery in the usual manner.

2. A wheal (fig. 1) of novocain solution is made on each side of the finger or fingers into which a "pin" is to be inserted. The level at which the needle is inserted corresponds to the proximal end of the distal phalanx. If the operator is at all in doubt as to the correct level, so as to miss the interphalangeal joint and epiphysis, he should consult the x-ray film or be directed by the fluoroscope. In this respect an examination of the finger under a fluoroscope before inserting the needle will give definite information as to the relationship of the bone to the finger tip.

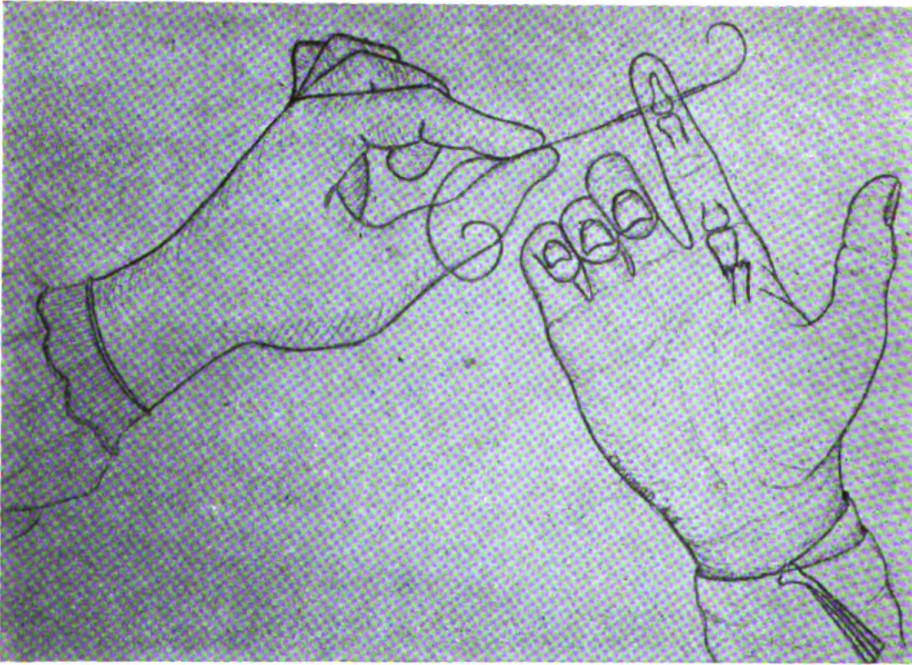


2. Intravenous needle attached to syringe bores through the bone.

3. A No. 20 Luer intravenous needle is attached to a 2- or 5-cc. Luer syringe which is then used as a handle. The needle is drilled by rotary motion through the distal phalanx (fig. 2). It will be found that a gentle rotary motion will force the needle through the bony structure of the distal phalanx without difficulty. The hub of the needle is broken off $\frac{1}{4}$ inch from the side of the finger, and the opposite or tip-end is cut off an equal distance from its side of the finger, with side-cutters. A loop of No. 26 soft wire (fig. 3) is threaded through the lumen of the needle and is tied over the finger-end so as to provide a loop for the attachment of traction.

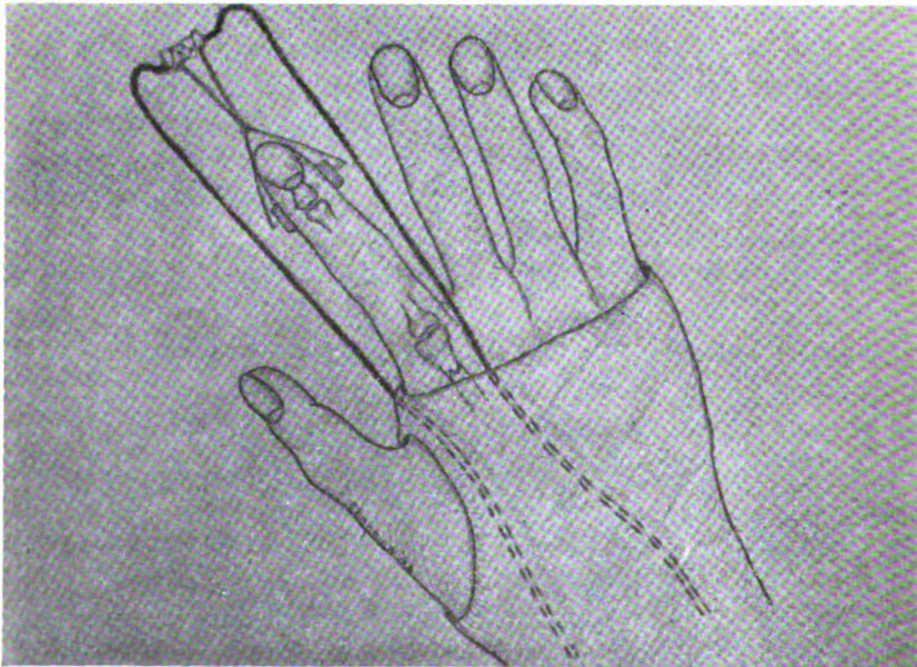
4. A plaster cast is applied to the forearm and hand, in which cast is incorporated a wire loop (coat hanger wire or welding rods), permitting the loop to be sufficiently long to extend well beyond the finger or fingers for which traction is desired. The plaster cast should extend on the palmar side well beyond the fracture site, and on the dorsal side may be cut out to the end of the proximal fragment. In this manner one is able to obtain moderate fixation of the upper fragment. In those fractures of the wrist, where traction is to be made on all the fingers, the plaster cast should extend only to the level of the fracture.

5. When the plaster cast has hardened sufficiently, the patient is given either a general anesthetic, or, if desired, local infiltration of the fracture site. Intravenous pentothal sodium provides a very satisfactory anesthetic. The fracture is manipulated, and any im-



3. A loop of soft wire is threaded through lumen of needle and made into a closed loop over the finger-end.

paction broken up (particularly in those fractures at the base of the first or thumb metacarpal, and distal end of the fifth or little finger metacarpal).



4. Rubber band traction from loop to heavy wire which has been incorporated in cast.

When reduction has been accomplished, rubber band traction is applied (fig. 4) with traction just sufficient to maintain the position of the fragments. Two strands of an ordinary rubber band, moderately taut, will usually suffice.

To take the place of the usual gauze dressing around either pin end, next to the skin wound, felt washers are prepared, sterilized and merely cut from their periphery through the line of one radius to their center, and then slipped over the "pin" as needed. The felt washers have proved more satisfactory than gauze, are not apt to fray and can be replaced with ease. They are cut out of $\frac{3}{8}$ -inch felt with a large punch, similar to a belt punch.

Aftercare.—The aftercare of these fractures is not difficult. It has been the practice of the author to use the small portable or hand fluoroscope to check the position of the bony fragments the day after application of traction. Not infrequently it is necessary to change the direction of the traction, bending the wire loop (wire loop incorporated in plaster cast) backward, forward or sideways, as desired. This will usually suffice to overcome any undesirable angulation. The upper proximal fragment being fixed by the plaster cast will tend to maintain its position, and the distal fragment can be alined to it.

The bones should be alined in satisfactory position within the first 48 hours, when a check x-ray film is made. Position is again checked at the end of the first week, and at that time there is usually a certain degree of "gluing" of the fragments, due no doubt to the adherence of the soft tissues about them. It is then possible to relax the rubber band momentarily to allow flexion of the finger, and each finger in turn, if others are involved. At the end of 3 or 4 weeks there is usually sufficient union to warrant removal of traction. The rubber band is removed, and the cast, with its wire loop, as well as the "pin" through the finger-end may remain until one is assured that further traction is unnecessary. At no time during treatment is traction intended to obtain reduction, but rather, to maintain it. It does not as a rule require much traction to accomplish this purpose.

COMMENT

It has been suggested that the pin be placed through a more proximal phalanx when the fracture involved the metacarpal bones or wrist, in order that fewer joints would be subjected to the strain of traction. In those patients treated with traction through the distal phalanx, there have been no joint disturbances during treatment or after return to duty. Furthermore, in order to place a hollow needle through a more proximal phalanx an actual hole

must be drilled through the bone because of its hardness, whereas the distal phalanx is sufficiently soft to permit drilling with mere rotary motion of the needle itself.

In a few instances the lumen of the needle has become crimped when the hollow needle was cut. This can be easily overcome by cutting the needle with the stylet in place, or if one chooses, by passing a file over the cut end.

Suturing silkworm gut, heavy dermal or silk, or even wire through the finger-end usually results in a pressure necrosis of the tissue at either side of the finger where the thread cuts into the soft tissue. The use of the hollow needle precludes this, and at the same time offers a firmer control of the bone, such as one finds in the use of the Steinmann pin or Kirschner wire. The needle must not extend too far beyond the sides of the finger; $\frac{1}{4}$ inch will usually provide sufficient spread. When too long, there is a tendency for the needle to bend and cut into the soft tissues as would the wire itself.

SUMMARY

A method is suggested and recommended for the insertion of a suitable "pin" (hollow needle) through the distal phalanx of the fingers to provide skeletal traction in certain fractures of the hand and wrist. This method has been used in a series of fractures with entirely satisfactory immediate and ultimate results.



CANCER OF THE RECTUM

Cancer of the rectum is particularly amenable to cure. Causing definite and usually early symptoms, the growth is so readily accessible for diagnosis that most cases should be discovered in an early stage. Metastases, usually late in developing, quite probably will not have occurred at the time the patient presents himself for treatment. Fortunately, also, should lymphatic involvement be present, not only the primary growth but those nodes most frequently first affected are readily removable. Patients with cancer of the rectum have a great likelihood of cure if they submit to a radical operation, for the five-year survival rate is higher than with most other forms of malignant growth.—McCORMICK, N. A.: Cancer of rectum. *Radiology* 42: 531-538, June 1944.

HIDDEN DEMENTIA PRAECOX

JOEL M. HILL

Lieutenant Commander (MC) U.S.N.R.

and

HAROLD M. HILDRETH

Lieutenant H-V (S) U.S.N.R.

Several cases of hidden dementia praecox have recently been encountered in the neuropsychiatric service at this U. S. Naval hospital. Each of the patients had well-established and marked schizophrenic trends of violence, which were so extraordinarily well concealed that the illness could easily have escaped detection. This article describes the presenting symptoms in these cases, the diagnostic signs, and the use made of psychometric technics in bringing to light the underlying pathologic disturbance in the schizophrenia. This was not evident in the routine psychiatric examination at this hospital.

INITIAL MANIFESTATIONS

Within the last few weeks five cases of hidden dementia praecox have been found. Four of them were in Negroes. All the patients had been in the Navy less than a year. In each case all the usual signs of dementia praecox were lacking. During the psychiatric examination all the patients were cooperative and responded to questions with reasonable adequacy. There were no mannerisms or compulsions, nor was there any bizarre behavior. External signs of tension were lacking. The volume of speech was normal, and no neologistic tendencies, odd speech forms, or peculiar usages of words were observed. Mental content showed no unusual material. Hallucinations and delusions were denied, and no suggestive tendency toward either could be elicited. No evidence of undue fantasy was uncovered. No affective inappropriateness was evident nor was there any flattening of mood beyond normal limits. Each patient did, however, give an impression of dullness. There was no silliness. One showed a tendency toward apathy and another had a slightly suspicious manner, but in neither case were these symptoms pronounced. There was no clear evidence of psychotic behavior in the records of these patients. Each had been sent in for examination because "he wasn't getting along well with others," or because "he needed a mental examination."

In initial appearance these patients did not conform to any one diagnostic type. Two suggested constitutional psychopathic inferiority without psychosis. One had a number of vague somatic complaints which could have been considered a psychoneurotic reaction. Another appeared to be mentally defective. In no case was there sufficient resemblance to these diagnostic types, however, for the illness to be considered typical.

The absence of any symptoms of dementia praecox at this stage was especially remarkable, because the psychiatric examination was neither hurried nor superficial. An unusual amount of time was spent with each patient, because of the absence of any clear-cut pathologic condition. It is significant that although the examination was intensive, the observations were not sufficiently conclusive to satisfy the examiner. With nothing specific to support the impression, the conviction persisted that "something was wrong" in each case. For this reason judgment was delayed until the patients were referred to the psychologist for psychometric examination.

The variety of psychometric technics now available for clinical use is greater than is generally realized. In addition to supplying information regarding the patient's intelligence, the psychometric approach often aids in uncovering new mental trends in patients as well as in substantiating those already observed. At this hospital we have made considerable use of these newer methods, particularly in dealing with atypical or obscure cases.

PSYCHOMETRIC EXAMINATION

The Stanford-Binet (1) (2) and Wechsler-Bellevue (3) tests were used along with the Kent EGY (4), and other standardized special tests (5) (6) (7) (8). In all five cases reported, the psychometric examination gave similar results.

First phase.—The first phase of the examination tested for original mental level, and established the fact that the man was not mentally defective. Three patients were of average intelligence. One was well above average, and the fifth showed borderline intelligence.

Second phase.—The second stage in the examination measured the functioning mental level and in all cases this was found to be well below the person's original mental level. Each case showed mental deterioration. This impairment of intellect is particularly significant in instances in which there is no organic brain injury, because it often indicates the presence of functional mental disease. Such patients, even under the best testing conditions, are unable to summon up their full mental capacity because of the intense concentration on their own trends of thought.

Third phase.—After the presence of mental deterioration was established, the next step was an examination of the pattern of impairment (9) (10) (11). This was found to be functional, and dementia praecox in type (12) (13) (14) (15), characterized by specific defects in manipulation of abstract symbols, relatively greater difficulty with numerical and spatial manipulation than with verbal, and a tendency toward bizarre errors in dealing with verbal material.

Fourth phase.—With the knowledge that the patient was mentally deteriorated, and that the deterioration was of a praecox type, the fourth step in the psychometric examination was directed toward eliciting other schizophrenic symptoms. Atypical responses given by the patient during testing were followed by encouraging him to elaborate on them and by asking the reason for his difficulty in concentrating on certain types of problems. This type of interviewing, following a series of test problems, tends to elicit hallucinations and delusional trends that previously have been concealed. This occurred in each of the five cases.

Fifth phase.—As soon as the hidden material began coming to light and the patient spoke freely, he was taken to the psychiatrist, and questioning was continued until the full scope of the patient's trends was elicited.

DEMENTIA PRAECOX

Each of the five patients admitted auditory hallucinations dating back from a few months to more than a year. In three cases the "voices" were making homicidal or suicidal suggestions to the patient. One had been in the brig because he had complied with voices telling him to attack a Marine guard. The fifth patient admitted being told only "silly" and "funny" stories by the voices. Four of the five patients also heard insults and "bad names" directed at them by the voices. Two of the patients had delusions of persecution well established, but not yet elaborately systematized. In the others delusional thinking was present at intervals but was not firmly established. Other symptoms were also admitted, such as a feeling of isolation and guilt, seclusiveness, fantasy and a sense of unreality. After these trends were brought to light, two of the patients became markedly disturbed. One, the most intelligent of the five, appeared more alert and normal for a few days. The other two showed no apparent change in their daily behavior.

The outstanding fact of interest in all cases was the extent of the schizophrenic pathologic state which, without the psychometric examination, was not evident. It may be that their military routine with its emphasis on suppression of individual aggressive drives

aided in concealing their symptoms. The fact that four of them were Negroes may be significant. Whatever the explanation, the dementia praecox was extremely well hidden. Had these patients been returned to civilian life or to duty, it is likely that at least one would have committed other acts of violence before the dementia praecox was recognized.

Case report.—An 18-year-old Negro, a steward's mate, third class, in good physical health, was admitted to this hospital because for 6 months he had been a disciplinary problem, having received four brig sentences, and for the previous 3 months, he had been in a brig for safe-keeping. There he was a continual source of annoyance to Marine guards because he frequently assaulted them without provocation.

The psychiatric examination, which lasted 1½ hours, elicited only that the patient was dull and evasive; his parents had been separated for several years because of his mother's alcoholism; he stammered since childhood; and he never had had a gainful occupation except occasional farming.

It was curious that so much time could be spent with a patient without obtaining data for a psychiatric diagnosis; therefore, a psychologic consultation was requested.

The psychometric examination showed a borderline intelligence with 15-percent deterioration at the time of examination. After the intelligence tests had been given the patient admitted to the psychologist in the presence of the psychiatrist the following data which, with the psychometric examination, gave evidence for the diagnosis of dementia praecox: For more than a year the patient had experienced auditory hallucinations which directed his conduct; he had struck Marine guards at the instigation of the voices; and voices also told him to paint a Rising Sun on his helmet, to wear a gas mask, and, thus attired, to eat at the officers' mess.

DIAGNOSTIC SIGNS

Because of the hazard of such patients to the public safety, and the fact that hidden dementia praecox is doubtless being encountered elsewhere in the service, the cases reported here were carefully reviewed for early signs and symptoms. It was mentioned that in each instance no clear symptom complex was brought to light even after prolonged psychiatric examination but that the examination, nevertheless, seemed inconclusive. The underlying pathologic state sensed by the examiner was found to be based on three separate impressions. So far as can be determined at present these impressions are the only early signs of this form of hidden dementia praecox: They are (1) dullness, (2) vagueness, and (3) frustration on the part of the examiner.

Dullness.—The first impression given by these patients is that of dullness. This impression is gained early and persists throughout the examination. At the same time, the patient's responses are not uniformly and consistently dull. Incongruously intelligent remarks are made occasionally.

Vagueness.—The second impression given by these patients is one of vagueness. It is not an easily perceptible type of vagueness, as in the case of patients whose responses are invariably tentative, indefinite, or equivocal. Specific questions are answered directly and relevantly, and without indecision. The vagueness comes in a failure to elaborate spontaneously at certain points, as a patient will do when questioning touches vital areas. Not that there is any absence of spontaneous production; it merely does not come at the proper time or it comes in such a way as not to throw any light on the patient's difficulties. He fails to demonstrate either a pathologic condition or normality. It is impossible to get a clear comprehension of him as a personality and an individual. This particular type of vagueness is not readily discernible but once it is recognized and understood, it can be clearly observed.

Examiner's frustration.—The third impression is the result of the vagueness described. As questioning continues unproductively over at least twice the usual time required for a trained psychiatrist to form an adequate diagnostic opinion, the patient's consistent failure to give any clear picture of himself leads to a gradual feeling of frustration on the part of the examiner. This feeling of annoyance is important because it is more readily apparent than the vagueness that causes it; it may be the first indication that one is dealing with hidden dementia praecox. Recognizing the source of irritation, one can give attention to the dullness and vagueness which the patient is demonstrating and can observe whether the symptoms are of the type described.

SUMMARY

1. Hidden dementia praecox, as found in five cases at a U. S. Naval hospital, is described.

2. In each of these cases the usual psychiatrically-elicited signs of dementia praecox were lacking.

3. In each case psychometric examination demonstrated the presence of mental deterioration and elicited the presence of auditory hallucinations and other schizophrenic trends.

4. When the schizophrenic reaction was brought to light, it proved in each case to be surprisingly advanced, despite the paucity of initial symptoms.

5. In each case the "voices" were directed at influencing the patient's conduct; and in four cases suicidal or homicidal trends were elicited.

6. In each case the condition was of the sort that might easily have invalidated the patient, so that he would have been discharged from the service on such grounds as constitutional psycho-

pathic inferiority without psychosis, psychoneurosis, or mental deficiency. The danger of sending into the community actively hallucinating patients with homicidal and suicidal trends is obvious.

7. The only signs in these cases of hidden dementia praecox observable by the usual psychiatric examination were: (1) An impression of dullness, "incongruous dullness;" (2) a peculiar form of vagueness in the patient's responses; and (3) a gradual sense of frustration produced in the examiner by this vagueness and dullness.

8. It is suggested that further observation and study of any patient with the symptoms described are warranted. A psychometric examination should be given if an experienced psychologist is available. If this is not possible, restriction of liberty, seclusion, and repeated interviewing may aid in bringing to light hidden dementia praecox.

REFERENCES

1. Terman, L. M.: *The Measurement of Intelligence*. Houghton Mifflin Co., Boston, 1916.
2. Terman, L. M., and Merrill, M. A.: *Measuring Intelligence: A Guide to the Administration of the New Revised Stanford-Binet Tests of Intelligence*. Houghton Mifflin Co., Boston, 1937.
3. Wechsler, D.: *The Measurement of Adult Intelligence*. Williams & Wilkins Co., Baltimore, 1939.
4. Kent, G. H.: *Oral Test for Emergency Use in Clinics*. Williams & Wilkins Co., Baltimore, 1932.
5. Babcock, H.: Experiment in measurement of mental deterioration. *Arch. Psychol.* No. 117, 1930.
6. Hayman, M.: Two minute clinical test for measurement of intellectual impairment in psychiatric disorders. *Arch. Neurol. & Psychiat.* 47: 454-464, March 1942.
7. Shipley, W. C., and Burlingame, C. C.: Convenient self-administering scale for measuring intellectual impairment in psychotics. *Am. J. Psychiat.* 97: 1313-1325, May 1941.
8. Wesley, S. M.: Study of use of recent memory tests in measurement of intellectual deterioration. *Psychol. Bull.* 39: 509-510, July 1942.
9. Bijou, S. W.: Psychometric pattern approach as aid to clinical analysis—review. *Am. J. Ment. Deficiency* 46: 354-362, January 1942.
10. Brown, J. F.; Rapaport, D.; Tillman, C. G.; and Dubin, S. S.: Analysis of scatter in test battery used in clinical diagnosis. *Psychol. Bull.* 38: 715, July 1941.
11. Roe, A., and Shakow, D.: Intelligence in mental disorder. *Ann. New York Acad. Sc.* 42: 361-490, January 31, 1942.
12. Babcock, H.: *Dementia Praecox; a Psychological Study*. Science Press Printing Co., New York, 1933.
13. Hildreth, H. M.: Psychometric patterns in diagnostic types. In preparation.
14. Rabin, A. I.: Differentiating psychometric patterns in schizophrenia and

- manic-depressive psychosis. *J. Abnorm. & Social Psychol.* 37: 270-272, April 1942.
15. SHAKOW, D.: Deterioration in schizophrenia as reflected in performance on variety of psychological tasks. *Psychol. Bull.* 39: 508, July 1942.



BACK PAIN AND GASTRO-INTESTINAL DISORDERS

Patients who have maladies involving digestive or accessory digestive organs, such as the gallbladder or the pancreas, frequently complain of pain in the back. Nor is this complaint of minor importance symptomatically to many of these patients. Indeed it is often the presenting, or even the sole, complaint. It may overshadow other symptoms in severity, and only careful evaluation will elicit the information that it is but one of the manifestations of a disease located in the gastrointestinal or accessory gastrointestinal tract. All of the diseases involving these tracts may cause pain referred to the back, and much information of the highest diagnostic and prognostic importance will be lost if such distress is not evaluated carefully. Back pain as one of the manifestations of gastrointestinal disease can result from a summation of impulses originating in visceral walls and referred to the back along the sympathetic nerves which carry such impulses to the spinal cord. Accurate localization of the involved organ or of erosive progression of histopathologic processes or even the detection of involvement of neighboring organs in the course of progression of a disease may be possible by means of critical scrutiny and proper evaluation of references of pain from the epigastrium to the thorax, neck or back.—RIVERS, A. B., and Roodenburg, A. I.: Back pain in disease of gastrointestinal and accessory gastrointestinal tract. *J.A.M.A.* 125: 421-426, June 10, 1944.



SUCCINYL SULFATHIAZOLE IN BOWEL SURGERY

In large bowel surgery specific measures have been directed against the risk of infection, both in the peritoneum and in the abdominal wall. They have consisted of: (1) Stage operation; (2) attempts to decrease the bulk content; and (3) attempts to alter or decrease the number of the organisms in the fecal stream. With increasing knowledge of the role of protein in the surgical patient, it is obvious that the so-called "colon preparation" diet is by no means an adequate diet in the preparation of patients for major surgical procedures, particularly of patients with gastro-intestinal lesions who may already have depleted protein reserves from preceding relative protein starvation. With succinyl sulfathiazole a new, more direct method of attack on intestinal bacteria is made and offers the opportunity for providing a better balanced and more palatable diet to patients with impending operations on the colon and rectum.—ARCHER, H. L., and LEHMAN, E. P.: Clinical and laboratory experiences with succinyl sulfathiazole. *Ann. Surg.* 119: 518-524, April 1944.

INVALIDINGS FROM THE SERVICE FOR CAUSES EXISTING PRIOR TO ENLISTMENT WOMEN'S RESERVES

HERBERT A. RASKIN
Pharmacist's Mate, first class, U.S.N.R.

In common with the male contingents of the Navy and Marine Corps, members of the Women's Reserve are subject to the maintenance of specified physical standards during their period of enlistment. When any individual consistently fails to meet these standards, he or she is subject to examination by a medical survey board and possible discharge from the service for the disabling condition. During this examination by the survey board, it is ascertained whether or not the condition is directly attributable to Naval service, or if it had existed prior to enlistment.

It is obvious that many of the diagnoses representing causes for separation from the service are characteristically peculiar to the female sex. However, many women are surveyed for diseases peculiar to both sexes. This paper therefore is an attempt to bring into the foreground all diseases or disabling conditions existing prior to enlistment, for which the enlisted personnel of the Women's Reserves of the Navy and Marine Corps have been invalided from the service.

Data for the period May 1943 through February 1944 have been studied. During this period there were received in the Bureau of Medicine and Surgery reports of medical survey on 820 Navy and Marine Corps women. Original compilations included both diagnosis and length of service, but the latter factor was discarded for purposes of this present study. This decision was brought about by the fact that the length of service prior to admission to the sick list for the disabling condition was not available, thus obviating any correlative investigation of time element and diagnosis.

Four tables are presented. Table 1 lists all the diagnoses categorized into 11 disease-groups. Tables 2, 3 and 4 offer in detail the individual diagnoses of the 3 ranking disease-groups, namely, psychiatric, respiratory, and genito-urinary.

From table 1 may be ascertained the frequencies of the 11 disease-groups among the individuals studied. In addition to the absolute frequencies there are included the percent each group is of the total number of invalidings from the service, plus the invaliding rate per 1,000 average strength. It will be observed that 4 of the

11 disease-groups accounted for 74.6 percent of the 820 individuals discharged, psychiatric diseases alone being responsible for over one-quarter of the total.

TABLE 1.—*Invalidings from the service for causes existing prior to enlistment—by disease groups*

Disease group	Frequency	Percent total invalidings	Invaliding rate per 1,000
Total all groups.....	820	100.0	22.1
Psychiatric diseases.....	231	28.2	6.2
Respiratory diseases.....	152	18.5	4.1
Genito-urinary diseases.....	147	17.9	4.0
Diseases of motor system.....	82	10.0	2.2
Diseases of eye and ear.....	68	8.3	1.8
Cardiovascular diseases*.....	41	5.0	1.1
Neurologic diseases.....	36	4.4	1.0
Endocrine diseases.....	12	1.5	0.3
Diseases of skin.....	11	1.3	0.3
Gastro-intestinal diseases.....	10	1.2	0.3
Miscellaneous diseases.....	30	3.7	0.8

* Includes hemic and lymphatic diseases.

When viewed on a rate per 1,000 basis, it is found that 22.1 women of every 1,000 in the service were discharged for diseases and disabilities. This rate corresponds very closely with a rejection rate of 19.9 per 1,000 persons examined in a study made early in 1943 of 11,136 women recruits receiving their active duty physical examination.

TABLE 2.—*Psychiatric diseases*

Disease	Frequency	Percent total invalidings	Percent total in group
All psychiatric diseases.....	231	28.2	100.0
Psychoneurosis.....	122	14.9	52.8
Mixed.....	34	4.1	14.7
Hysteria.....	30	3.7	13.0
Anxiety neurosis.....	18	2.2	7.8
Unclassified.....	16	2.0	6.9
Neurasthenia.....	14	1.7	6.1
Situational.....	7	0.9	3.0
Traumatic.....	2	0.2	0.9
Psychasthenia.....	1	0.1	0.4
Constitutional psychopathic state.....	51	6.2	22.1
Emotional instability.....	31	3.8	13.4
Schisoid personality.....	12	1.5	5.2
Inadequate personality.....	5	0.6	2.2
Paranoid personality.....	3	0.4	1.3
Dementia praecox.....	26	3.2	11.3
Psychosis, manic depressive.....	15	1.8	6.5
Simple adult maladjustment.....	10	1.2	4.3
Depression, reactive.....	2	0.2	0.9
Nostalgia.....	2	0.2	0.9
Effort syndrome.....	1	0.1	0.4
Eauresis.....	1	0.1	0.4
Mental deficiency, moron.....	1	0.1	0.4

Psychiatric diseases.—In table 2, as in tables 3 and 4, no invaliding rates are presented; instead the percent each individual diagnosis is of the disease-group total is substituted.

It may be observed that the subgroup of all psychoneuroses was responsible for 52.8 percent of all psychiatric diseases, and 14.9 percent of all invalidings from the service. Psychoneurosis, mixed, and psychoneurosis, hysteria, accounted for more than half of the psychoneuroses. Worthy of special note is the fact that 11.3 percent of the invalidings for psychiatric diseases were due to dementia praecox.

TABLE 3.—*Respiratory diseases*

Disease	Frequency	Percent total invalidings	Percent total in group
All respiratory diseases.....	152	18.5	100.0
Tuberculosis, pulmonary.....	119	14.5	78.3
Chronic, arrested.....	102	12.4	67.1
Chronic, active.....	14	1.7	9.2
Unstable, primary complex.....	3	0.4	2.0
Asthma.....	14	1.7	9.2
Rhinitis, atrophic.....	8	1.0	5.3
Calculus, lungs.....	3	0.4	2.0
Pleurisy, fibrinous.....	2	0.2	1.3
Bronchitis, chronic.....	2	0.2	1.3
Bronchiectasis.....	1	0.1	0.7
Epistaxis.....	1	0.1	0.7
Rhinitis, hypertrophic.....	1	0.1	0.7
Tumor, lung.....	1	0.1	0.7

Respiratory diseases.—Included in this disease-group is one of the most outstanding points of the entire paper, that of the very high incidence of pulmonary tuberculosis. Of the 152 individuals invalided from the service because of respiratory diseases, 119 or 78.3 percent were due to this disease. Pulmonary tuberculosis accounted for 14.5 percent of the total for all invalidings. As would be expected 85.7 percent of these tuberculosis cases were of the chronic arrested type. There were no discharges for tuberculosis other than pulmonary.

Of further interest is the fact that during May and June 1943 (the first 2 months of the study period) 62 of the 119 reports of medical survey for pulmonary tuberculosis were received. The remaining 57 cases were distributed with decreasing frequency over the last 7 months of the period. Despite this apparently favorable trend, however, the fact remains that these cases of tuberculosis were not discovered until the individual had arrived at an indoctrination station, already having been sworn into the Navy. When cognizance is taken of the intricate process involved in invaliding a person, the cost in time, effort, personnel, financial ex-

penditure, hospital space, etc., the full significance of keeping the frequency of such discharges at a minimum is easily appreciated. A recent study of tuberculosis in the U. S. Navy¹ indicated the efficacy of including chest roentgenographic studies in pre-induction physical examinations of male recruits. A comparable program initiated into the physical processing of women recruits would undoubtedly tend to cull out the tuberculosis prior to their actual entrance into the service.

TABLE 4.—*Genito-urinary diseases*

Disease	Frequency	Percent total invalidings	Percent total in group
All genito-urinary diseases.....	147	17.9	100.0
Salpingitis.....	57	7.0	38.8
Cyst, ovarian.....	28	3.4	19.0
Tumor, uterus.....	16	2.0	10.9
Dysmenorrhea.....	9	1.1	6.1
Displacement, uterus.....	5	0.6	3.4
Menopause.....	5	0.6	3.4
Metrorrhagia.....	3	0.4	2.0
Gonococcal infection, cervix.....	3	0.4	2.0
Amenorrhea.....	2	0.2	1.4
Adherent retroversion, uterus.....	2	0.2	1.4
Menorrhagia.....	2	0.2	1.4
Syphilis.....	2	0.2	1.4
Nephroptosis.....	2	0.2	1.4
Cervicitis.....	1	0.1	0.7
Cystocele.....	1	0.1	0.7
Cystitis, chronic, nonvenereal.....	1	0.1	0.7
Displacement, ovary.....	1	0.1	0.7
Gonococcal infection, Bartholin's gland.....	1	0.1	0.7
Oophoritis.....	1	0.1	0.7
Prolapse, uterus.....	1	0.1	0.7
Calculus, kidney.....	1	0.1	0.7
Albuminuria.....	1	0.1	0.7
Nephritis, chronic.....	1	0.1	0.7
Abscess, Bartholin's gland.....	1	0.1	0.7

Genito-urinary diseases.—Most of the diseases listed in this group are characteristically limited to members of the female sex. Of the 24 diagnoses listed, only 3, salpingitis, ovarian cyst, and uterine tumor accounted for 68.7 percent of all genito-urinary diseases. Except for pulmonary tuberculosis, the diagnosis of salpingitis (7.0 percent of all invalidings) has the highest frequency for any single diagnosis.

HIGHLIGHTS OF OTHER DISEASE-GROUPS

1. Diseases of motor system:

- a. Twenty-six individual diagnoses (82 cases).
- b. Four diagnoses comprised 51.2 percent of the group total; arthritis, 13; curvature, spine, 11; flat foot, 12; internal derangement of joint, 6.

¹SMILEY, D. F., and RASKIN, H. A.: Tuberculosis as Navy problem. *Dis. of Chest* 10: 210-233, May-June 1944.

2. Diseases of eye and ear:
 - a. Eleven diagnoses (68 cases).
 - b. Otitis media (38) accounted for 58.9 percent of group total. Addition of myopia (9) and deafness, bilateral (8) raises this percentage value to 80.9 percent.
3. Cardiovascular diseases:
 - a. Eleven diagnoses (41 cases).
 - b. Valvular heart disease (18), 43.9 percent of group total; addition of arterial hypertension makes this 61.0 percent.
4. Neurologic diseases:
 - a. Ten diagnoses (36 cases).
 - b. Epilepsy (23), 63.9 percent of group total.
5. Endocrine diseases:
 - a. Six diagnoses (12 cases).
 - b. Hyperthyroidism (7), 58.3 percent of group total.
6. Gastro-intestinal diseases:
 - a. Seven diagnoses (10 cases).
 - b. Ulcer, duodenum (4), 40.0 percent of group total.
7. Miscellaneous diseases:
 - a. Thirteen diagnoses (30 cases).
 - b. Dental conditions (malocclusion, 2; absence, acquired, 12; caries, 1) accounted for 50.0 percent of group total.

CONCLUSIONS

It is quite obvious that even though the statistics presented are of considerable interest, they still leave many questions unanswered. They may be viewed merely as a descriptive exposition of 820 women discharged from the Navy and Marine Corps because of some disease or physical disability.

These data do, however, point the way toward further research in the field of morbidity statistics among members of the Women's Reserves. Such research, entailing statistical investigation of a group of females as compared with a control group of males, would provide a far greater understanding of the medical problems of women in the armed forces than now exists.

MAXILLOFACIAL KODACHROME PHOTOGRAPHY

JOHN W. RICHTER
Lieutenant (DC) U.S.N.R.

This article has been prepared to aid the medical or dental officer who wishes to record pathologic conditions as a routine procedure.

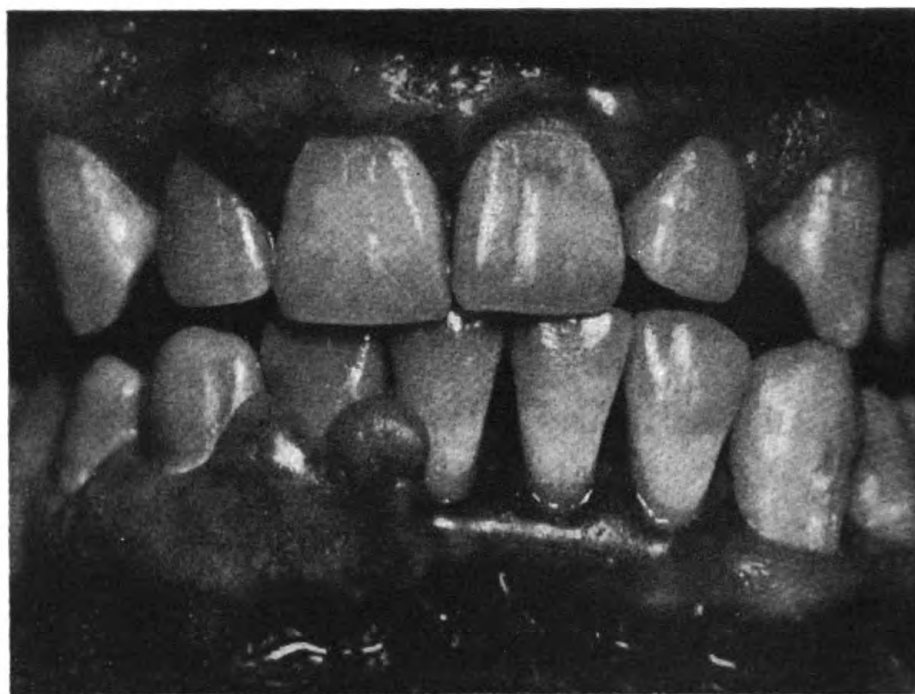
Black and white prints in photography of the face are quite helpful (fig. 1). Fair prints can be enlarged from original color transparencies if proper care of the intermediate negative is taken (fig. 2).



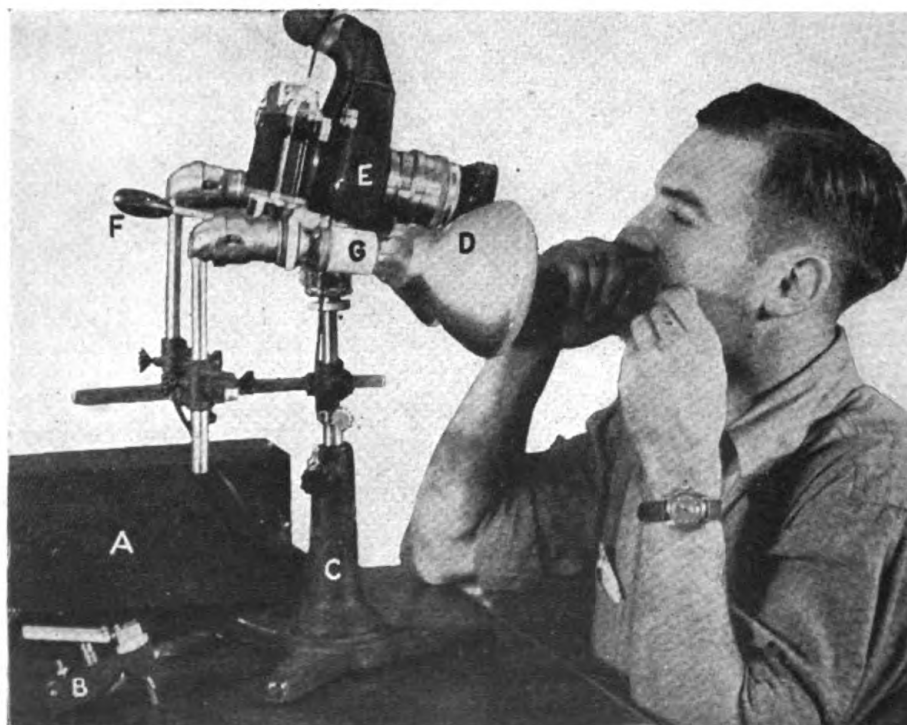
1. Appearance after gingivectomy.

In an attempt to reduce equipment to a minimum, two sources of illumination were selected, i.e., the R.2. foto-flood and the "SM" flash bulb. This light (fig. 3, D) is used in the identification card camera. Its advantages are fourfold: (1) It is color balanced for type A kodachrome (the film advocated) ; (2) it contains its own reflector; (3) it is dust-free; (4) because of its small size, it can be mounted on either side of the lens, close to its optical axis.

Although the light lasts only 6 hours, by using a resistance in the line while focusing, it can expose eight rolls of film before darkening.



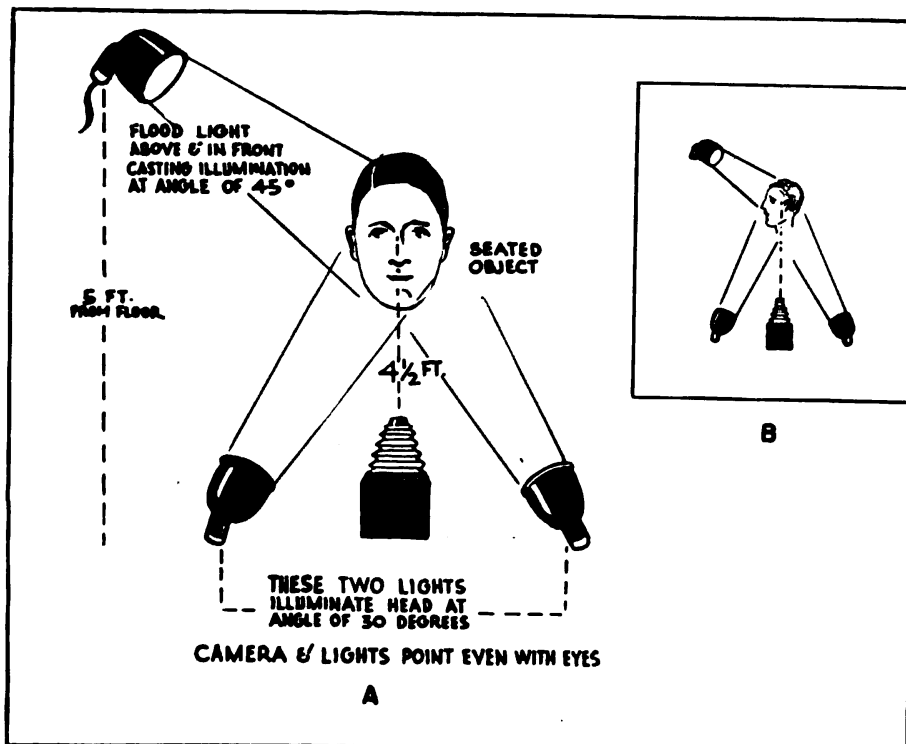
2. Leukoplakia. Reproduction in black and white from an original kodachrome. The intermediate negative of panchromatic fine-grain film was underdeveloped to prevent harsh contrast.



3. Equipment used in maxillofacial kodachrome photography. Of special interest is the resistance (A) and a fixed relationship of the camera and lights (D and E). B: Switch. F: Handle of tripod head on which camera rests. G: Universal joint.

The other source of illumination is the "SM" bulb, manufactured by the General Electric Company. The effective flash duration of this peanut-sized bulb is $1/200$ sec., making it ideal for eye photography. Further, its color temperature, lying between 3200K and 3430K, permits its use for kodachrome film without the need for a correction filter. It need not be used other than for eye photography except when no line current exists, or when 4.32 amperes cannot be drawn from a 115 volt circuit.

Flat lighting is the basis of all kodachrome photography (fig. 3, D). This light setup is varied for the full face and profile by the introduction of a third light. Although the lights on each side of the camera are sufficient to make the exposure, the third light, as added, gives to the full face modeling, and to the profile, edge lighting (fig. 4, A and B).



4. Arrangement of floodlights for kodachrome photography. A: Modeling given to full face. B: Edge lighting to profile.

The shadows cast by the third light are soft and luminous; at no time should they be so dense as to obscure skin detail.

Table 1 is offered as a guide to the first exposure. Shutter speeds and differences in line voltage vary these figures given in the table somewhat for each operator.

The ratio M signifies the amount of reduction (or magnification) of the film image. Any camera making the reductions cited in the table must be adjusted to the corresponding diaphragm stop and

shutter speed. When the image on the film is made to equal the size of the eye, for example, all cameras will obtain a good exposure with the data on lines 1 or 2.

TABLE 1.—*Exposure*

$M = \frac{\text{Size of object}}{\text{Size of image}}$	Source of illumination	Object distance of illuminants	Diaphragm stops	Speed sec.
$M = 1:1$	2 R.2 floods	10"	f 16	1/10
$M = 1:1$	1 "SM" flash	10"	f 11	Open
$M = 1:3/2$	2 R.2 floods	12"	f 11	1/10
$M = 1:1/16$	3 R.2 floods	54"	f 5.6	1/10

EQUIPMENT

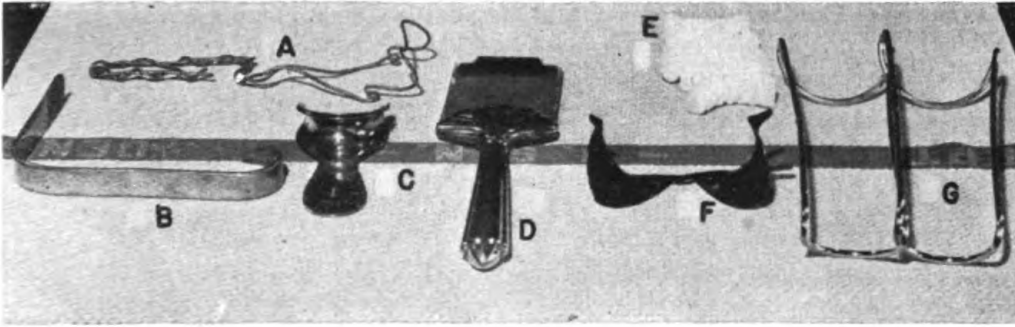
Any camera having adjustments doubling its focal length either by bellows draw or by extension tubes can be used for this type of photography. Another important feature of such a camera is its ground glass focusing, the use of which eliminates parallax and delineates the field of view.

The speed graphic is a standard instrument in the armed forces, but the continuous use of this camera for the task described would not be one of choice.

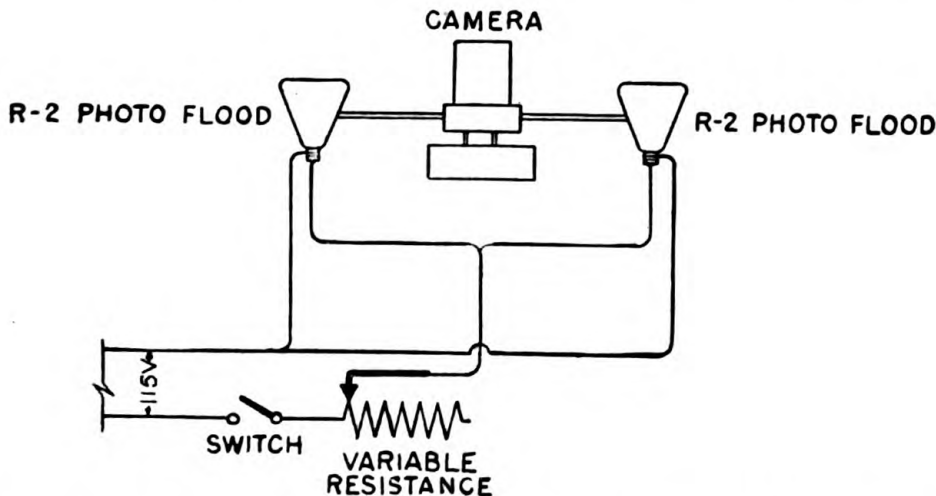
After a great deal of trial, the equipment illustrated in figure 3 was assembled. Its essential feature is the mounting of both lights and camera as a single unit. Another important detail is the resistance (A), which is connected in series with the lights while focusing and is then cut out of the circuit by switch (B) during the exposure. F is the handle of the tripod head on which the camera rests. The lens, the reflex housing, and the camera box (E) have been designed for ophthalmic photography. G is a universal joint which positions each lamp parallel to the long axis of the lens. The stand (C) which weighs about 30 pounds sustains both the camera and the lights and is moved to focus.

By far the most useful retractor in mouth photography has proved to be (C) shown in figure 5, the surfaces of which were defaced to overcome specular reflections. Likewise to overcome reflection, the wet surfaces of the teeth must be dried with cotton before the shutter is released.

When the reflex housing is disengaged, and the lens is connected directly to the back, the camera is capable of portrait photography.



5. Accessories. These instruments are used in oral photography. Of special interest is the home-made retractor (A) and the shoulders cut into the mirror (D). C: Retractor with surfaces defaced to overcome specular reflections. B, F, and G: Other types of retractors. E: Cotton rolls.

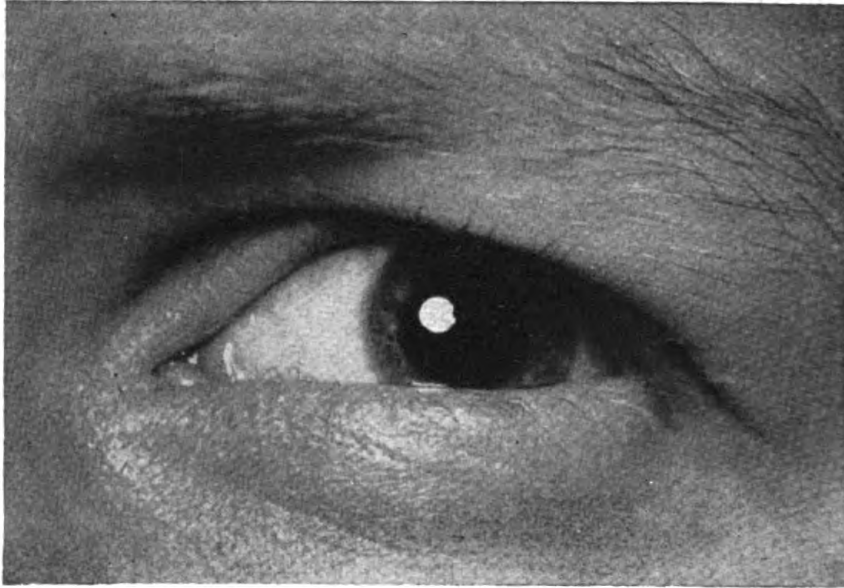


6. Schematic drawing showing electrical hook-up for obtaining any degree of light intensity.

An electrical circuit useful in maxillofacial photography is shown in figure 6. Both the stand and the electrical connections can be made by skilled personnel found on large stations. The plan of wiring illustrated is simple. The essential features of such construction are the mounting of both lights and camera on a sturdily weighted stand, and having a resistance in the circuit to preserve the floodlights and prevent discomfort to the patient.

DEPTH OF FIELD AND CRITICAL PLANE OF FOCUS

Two problems in close-up photography are the depth of field and the critical plane (or point) of focus. In photography of the eye, for example, in which the image eye is made to equal the human eye, it is important to consult a depth-of-field table to obtain all-over sharpness.



7. Eye: When the catch-light is round, small and away from the pathologic area, it is not objectionable in color photography.

TABLE 2.—*Depth of field*

$M = \frac{\text{Object size}}{\text{Image size}}$	f 11	f 16	f 22	f 32
1:1	.3	.32	.4	.6
1:1.5	.4	.6	.8	1.2
1:2	.5	1	1.3	2.5

It is well known that the depth of field becomes shallower as the image size increases. In photography of the eye, for example, this distance equals .3" with a diaphragm aperture of f 11. In order to obtain a sharp reproduction, one must select a point .15" into the field on which to focus. This point, at the midway mark, is the critical point for this magnification and is located near the limbus of the eye. For reductions (lines 2 and 3 in the depth-of-field table) a point one-third into the field is selected.

Two obvious precautions should be mentioned: Position the patient's head to preclude movement, and exclude daylight.

SUMMARY

1. By pre-setting the lens at known distances from the film, four useful image sizes are produced.

2. The data on exposure and depth of field apply to all cameras producing these image sizes.

3. One type film is selected, K135A, because it is available; it is small in size for shipping and filing, and it can serve as a master film for enlargements into larger size kodachrome or into black and white prints.

4. By constructing a compact unit of lights and camera, the busy medical officer can use this instrument with precision and speed.



CAUSES OF JAUNDICE

On the pathogenesis of the various types of hyperbilirubinaemia it is possible to classify jaundice in several ways:

1. Retention jaundice, caused by inability of the liver to take up all the bilirubin that reaches it so that some remains in the general circulation, and regurgitation jaundice, caused by obstructed outflow through the ducts or changes in the liver cells which disable them for excreting the bilirubin into the bile canaliculi, so that they excrete it into the blood and lymph instead.

2. Hemolytic jaundice, caused by an overproduction of bilirubin, so that more remains than can be disposed of by the body.

3. Obstructive jaundice, caused by an obstruction to the outflow in the bile ducts with overflow of the bile into the blood and lymph.

4. Toxic, or infective (hepatocellular jaundice), caused by damage to the hepatic cells, impairing their ability both to take up bilirubin from the blood and to excrete it into the bile passages.—PORTIS, S. A.: Jaundice. Clinics 2: 1568-1585, April 1944.



THIOURACIL

Thiouracil causes a decrease in the protein-bound iodine of the blood and in the thyroxin iodine of the thyroid gland, but does not inhibit the hypermetabolic effects of preformed thyroxin. These facts indicate that thiouracil inhibits the production of the thyroid hormone, but the exact process by which this is accomplished has not yet been determined. The drug can be depended on in essentially all cases to lower the basal metabolic rate to a normal range and to maintain it at that level so long as treatment is continued. Associated with this response in the basal metabolic rate is a clinical remission of the disease, with disappearance of tachycardia, hyperhidrosis, nervousness, diarrhea, weight loss and other toxic manifestations.

By accurately regulating the dosage of thiouracil it is believed that the goitrogenic effect can be kept low. In spite of the fact that many thyroid glands have decreased in size with treatment, it is not considered advisable to give prolonged thiouracil treatment to a patient who has an extremely large gland, since there is some possibility that the gland will actually become larger.—WILLIAMS, R. H., and CLUTE, H. M.: Thiouracil in treatment of thyrotoxicosis; report of seventy-two cases. New England J. Med. 230: 657-667, June 1, 1944.

THERMAL STIMULI IN OPERATIVE DENTISTRY

CONTROL OF PAIN

MILTON B. ENGEL
Lieutenant (DC) U.S.N.R.

Pain in operative dentistry is probably more frequently induced by the frictional heat of the revolving cutting or grinding instrument than by any other single factor. Henschel (1) has pointed out that this trauma may be due to heat distributed over a large area or by the frictional heat concentrated at the point of contact of the instrument with the tooth. In the latter instance he estimates a rise in temperature of from 67.5° F. to 270° F. It has been demonstrated experimentally (2) (3) (4) (5) that heat sufficient to produce severe trauma may be generated. Thomas (6) using previously chilled burs was able to reduce the operative pain substantially in 77 percent of his cases.

The use of water during the cutting procedure is effective in combating pain. Many operators, however, have rejected this method and prefer to work in a dry field because they believe that the water obscures operative visibility.

METHOD

The following method, employed over a 6-year period, overcomes the objection regarding visibility and has proved effective in pain control:

A spray of water from an atomizer bottle is employed to bathe the revolving bur, stone, or carborundum disk. The spray is directed at the point of contact of the instrument with the tooth as is shown in the accompanying illustration.

The air forces the water into and immediately out of the cavity, so that the thermal change is minimized and the tooth is covered by only a thin film of water which does not interfere with visibility. It is important that sufficient air pressure be maintained (approximately from 15 to 25 pounds per square inch) to prevent the accumulation of water in the cavity, for this would obscure the field. The water is removed from the mouth by the saliva ejector.

The incidence of pain resulting from thermal shock is reduced by the water spray, and the danger of irreparable pulpal trauma is eliminated. In addition to its effectiveness in thermal pain control, this water-spray procedure washes the tooth grindings from the cutting surfaces of the instruments.



Direction of spray: At point of contact of instrument with tooth.

It is helpful but not essential to have the assistance of a dental technician in this recommended adjunct to dental operative procedure.

REFERENCES

1. HENSCHER, C. F.: Heat impact of revolving instruments on vital dentin tubules. *J. Dent. Research* 22: 323-333, August 1943.
2. BÖDECKER, C. F.: Practical dental histology; treatment of sensitive teeth. *Dent. Cosmos* 70: 893-906, September 1928.
3. BRONNER, F. J.: Revolving motion vs. rectilinear motion. *Dent. Cosmos* 75: 491-496, May 1933.
4. JESERICH, P. H.: Factors necessary to minimize thermal changes in tooth structure from operative procedures. *New York J. Dent.* 5: 275-280, 1935.
5. WILSON, G. W.: *Year Book of Dentistry*. Year Book Publishers, Inc., Chicago, 1939.
6. THOMAS, B. O. A.: Effectiveness of chilled burs in eliminating pain. *J. Dent. Research* 30: 361-367, August 1940.

PAIN RELIEF

ALFRED M. ROCHESTER
Lieutenant Commander (DC) U.S.N.R.

The pain research laboratory of Cornell University Medical College found that all people, of all ages and both sexes, no matter how sensitive or insensitive they think they are, have exactly the same sensitivity to pain; hence, we may assume that the threshold of pain for everyone is the same, although neurotic tendencies may produce variations.

SUGGESTIONS REGARDING ANESTHESIA

Some of the simpler aspects of regional or local infiltration anesthesia are frequently overlooked:

1. Procaine hydrochloride is a protoplasmic poison and should therefore be used discriminately and sparingly. There is a temptation to inject a little more solution than is required so as to be certain of anesthesia. Only the minimum amount adequate to obtain the maximum degree of anesthesia should be used. This helps reduce the incidence of postoperative pain.

2. Procaine hydrochloride and sulfa compounds are incompatible.

3. It is not necessary to make subperiosteal injections in regional infiltration anesthesia. It is my opinion that this procedure and also intra-osseous injections should not be employed.

4. Supraperiosteal injections at the mucobuccal fold will give sufficient anesthesia.

5. To find the proper point for injecting at the mucobuccal fold, the mucous membrane should be dried slightly and drawn away from the teeth and down in the maxillary region, up in the mandibular region.

6. Although there is some difference of opinion relative to the lower bicuspids, infiltration anesthesia is effective for all operative procedures in the mouth except in the mandibular molar region.

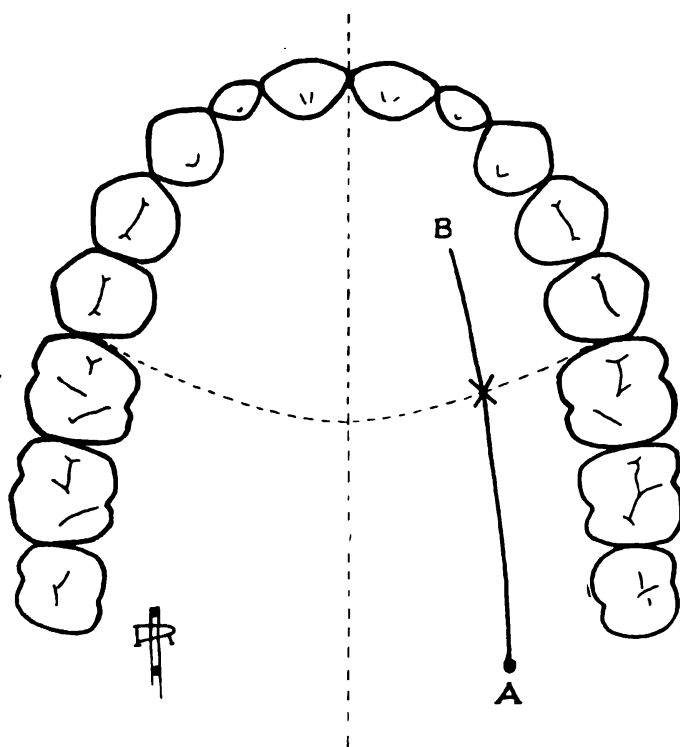
7. In mandibular injections, it is inadvisable to make low needle insertions on the lingual side in the floor of the mouth. This is unnecessary and may be dangerous.

- (a) The proper place to make lingual mandibular injections is the alveolar crest not more than from one-eighth to one-fourth inch lingual to the tooth.

- (b) From 0.5 to 1 cc. of solution is adequate. This will anesthetize the entire root.

8. When injecting labially and buccally, or externally, either in the upper or lower jaw, no more membrane punctures should be made than are absolutely necessary.

9. For adjoining teeth, insert the needle carefully at the mucobuccal fold between them, and direct the syringe first anteriorly and then posteriorly for each deposit of solution, withdrawing slightly in making the change of position.



A to B: Path of anterior palatine nerve. X: Point of injection.
See paragraph 10 in text.

10. In maxillary lingual injections, it should be borne in mind that the anterior palatine nerve runs from the posterior palatine foramen, which is posterior and mesial to the third molar, anteriorly to the cuspid about half-way between the raphe and the necks of the teeth. An injection at a point on this line between the second bicuspid and first molar will usually give anesthesia over this entire area as it is effective both anteriorly and posteriorly, anteriorly by block anesthesia and posteriorly by infiltration. (See "X" on accompanying diagram.) This is an efficient injection.

(a) For the third molar, one or two additional drops will be needed.

(b) By injecting on a line between the bicuspid and molar, choking or gagging is prevented.

(c) The needle should be held parallel to the long axis of the teeth during insertion.

(d) From 4 to 6 drops, or less than 0.5 cc., will suffice for this injection.

(e) If several upper incisors are to be extracted the nasopalatine injection at the anterior palatine foramen is preferable lingually. This should be made only about a fourth of an inch on the median line, posterior to the centrals with the needle again parallel to the long axis of the teeth.

11. In the maxillary external (buccal) area the effect of anesthesia is directed backward and downward; consequently in all except the maxillary molars, the anesthetic solution should be injected slightly mesial to and on a level with the apexes.

12. In the molar region, the needle should be inserted so that the solution is deposited over the mesial apex of the molar to be anesthetized.

13. A 2-percent procaine solution with epinephrine, either 1:25,000 or 1:50,000, is desirable. When epinephrine 1:25,000 is used, even less procaine is necessary as the anesthesia is intensified by the vasoconstrictor action; as less solution is used, the patient receives almost the same amount of epinephrine as in the 1:50,000 solution.

14. The gage of the needle used is relatively unimportant. It is important that the point be sharp.

15. Mandibular conductive injection is sometimes necessary. There are instances when the infra-orbital and posterior-superior dental injections are desirable but these procedures may be dangerous or produce ecchymosis. These are almost as simple with proper application as the infiltration type of local anesthesia.

AIDS TO PAIN CONTROL

Such aids as careful grinding to prevent unnecessary heating; a tepid water stream, sharp burs, and diamond burs (when available) are truisms in dental operative finesse.

Supplementary medication is sometimes indicated, such as for the reduction and fixation of fractures. Such sedatives as phenobarbital or nembutal are usually adequate. It is seldom necessary to employ codeine or morphine.

COMMENT

The same attention should be given to pain control for patients in the Navy as for apprehensive patients in a private practice. This does not imply that patients should be pampered. On some occasions, judicious firmness is indicated.

DENTAL DEPARTMENT ON A TROOP EVACUATION SHIP

ALBERT B. LARSON
Lieutenant Commander (DC) U.S.N.

This article describes some of the dental problems and their solution on a major troop and hospital evacuation ship operating between the United States and the Southwest Pacific. The dental department was organized during the transportation of Marines for the Guadalcanal campaign. Before the voyage was completed approximately 8 percent of the troops reported to dental sick call. Most oral disease was activated by the sudden change to crowded quarters, inactivity, and neglect of oral hygiene.

Vincent's infection, pericoronitis, acute and subacute alveolar abscesses, and trigeminal nerve disturbances of vague origin constituted most of the disorders.

Vincent's infection.—Vincent's infection was found to be most effectively treated by having the patient report to the dental office twice a day for the following routine:

1. The mouth is thoroughly flushed with alternate rinsings of warm water and dilute hydrogen peroxide to remove all food particles and viscous deposits on the gingival tissue.
2. After a final flushing with water, the mouth is dried with the aspirator, and a solution of gentian violet applied to the gum tissue. It is important that the gentian violet solution be made by first dissolving the crystals in the minimum amount of alcohol necessary to put the crystals into solution and then adding water to get a 5-percent solution.
3. Sulfathiazole tablets ($7\frac{1}{2}$ grains) are used as lozenges, 1 every 3 hours, during the acute stage.
4. Smoking and exchange of canteens are prohibited.
5. Oral prophylaxis is done after the acute symptoms subside.
6. The focal points are located and removed. If tonsil crypts appear to be the etiologic factor, the patient is referred to the medical officer.

Pericoronitis.—1. The time element in treating pericoronitis has been decreased by using the treatment on the inflamed area which has been described for Vincent's infection. Usually 2 or 3 days' treatment is sufficient to prepare the area for surgery.

2. If a maloccluded upper third molar is believed to be the causative factor of a mandibular pericoronitis, it is extracted.

3. A surgical dressing paste of coarse sulfanilamide granules, saturated with eugenol, has given excellent results in preventing postoperative infections in 63 removals of impacted mandibular third molars. This paste (1½ gm. or less, depending on the size of the wound) is placed in the socket immediately after the tooth is removed.

4. The gum flap is sutured tightly into place.

5. Postoperative pain is negligible and postoperative care is minimal.

Dry socket.—The so-called dry socket is effectively treated with the surgical dressing paste impregnated in iodoform gauze. The socket should be flushed and thoroughly dried prior to tamponage with this dressing, as saliva will prevent the action of the paste. Usually three daily dressings will permit development of healthy granulation tissue in the socket.

Infections and neuralgias.—Apparently devitalized pulps and chronic apical abscesses reacted to the vibration and motion of the ship. Acute infections were treated by the generally accepted method of incision and drainage prior to extraction.

The cause of vague trigeminal neuralgias was usually found to be a pulpless tooth. The electric pulp tester proved to be the instrument of greatest diagnostic value in locating these teeth.

ROENTGENOGRAPHY

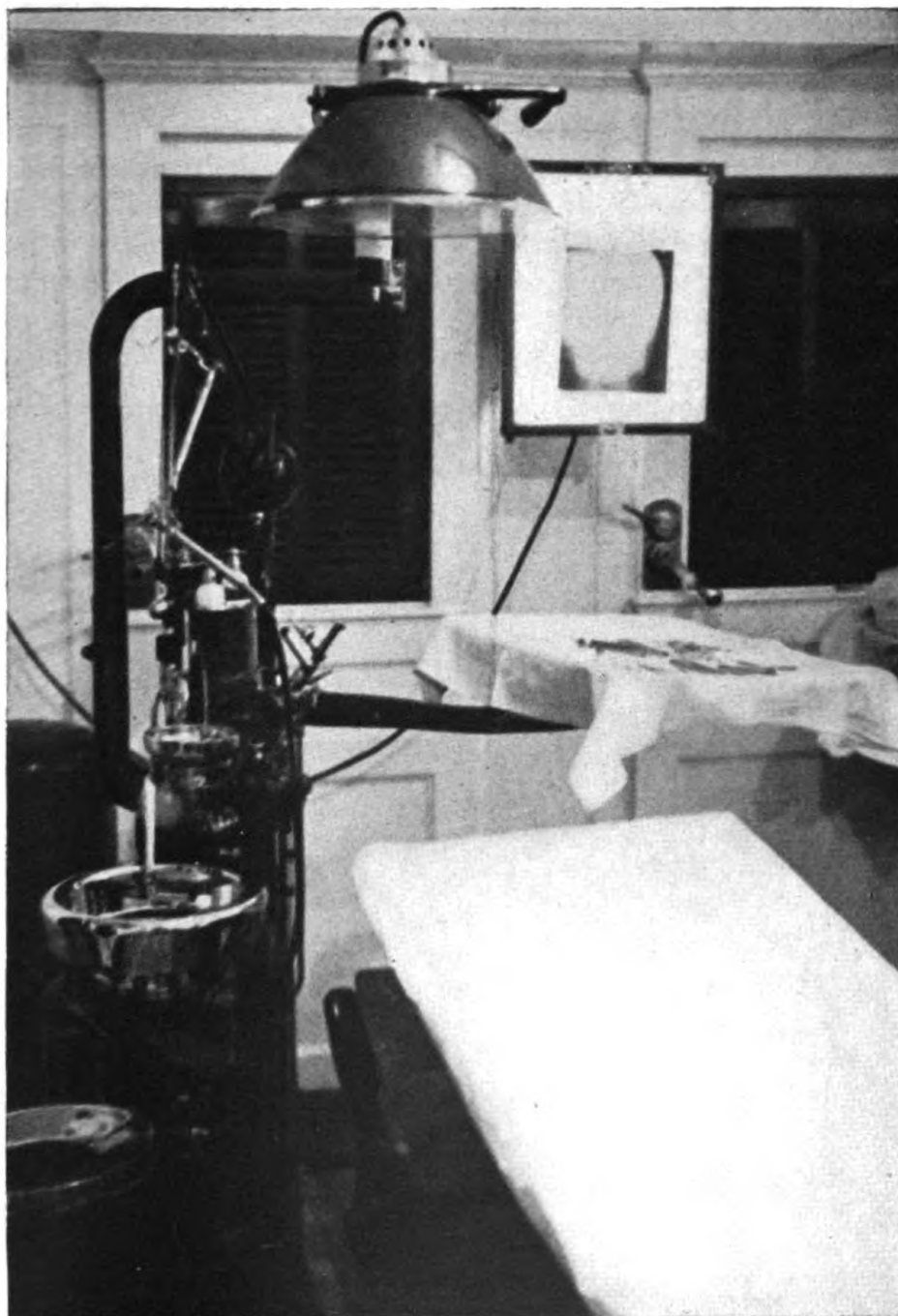
The dental department does all the roentgenography aboard ship. As the ship operates for the most part in tropical latitudes, the problem of maintaining x-ray solutions at a temperature of 65° F. was solved by keeping the solutions in gallon bottles in the refrigerator and using developing trays instead of tanks. Photographic trays, 8 by 10 inches, are usually adequate, and a baking tray, 22 by 15 inches, borrowed from the ship's galley, was found to be excellent for the larger x-ray films.

MISCELLANEOUS EQUIPMENT

Aspirator.—Fresh water is conserved by using the motor-driven aspirator instead of the saliva ejector.

Operating gown.—Naval hospital pajama tops, worn reversed, have been used as cool and neat operating gowns in equatorial latitudes.

Operating table.—Surgery is facilitated by using a portable operating table (fig. 1) which can be slipped over the dental chair and under the dental operating light.



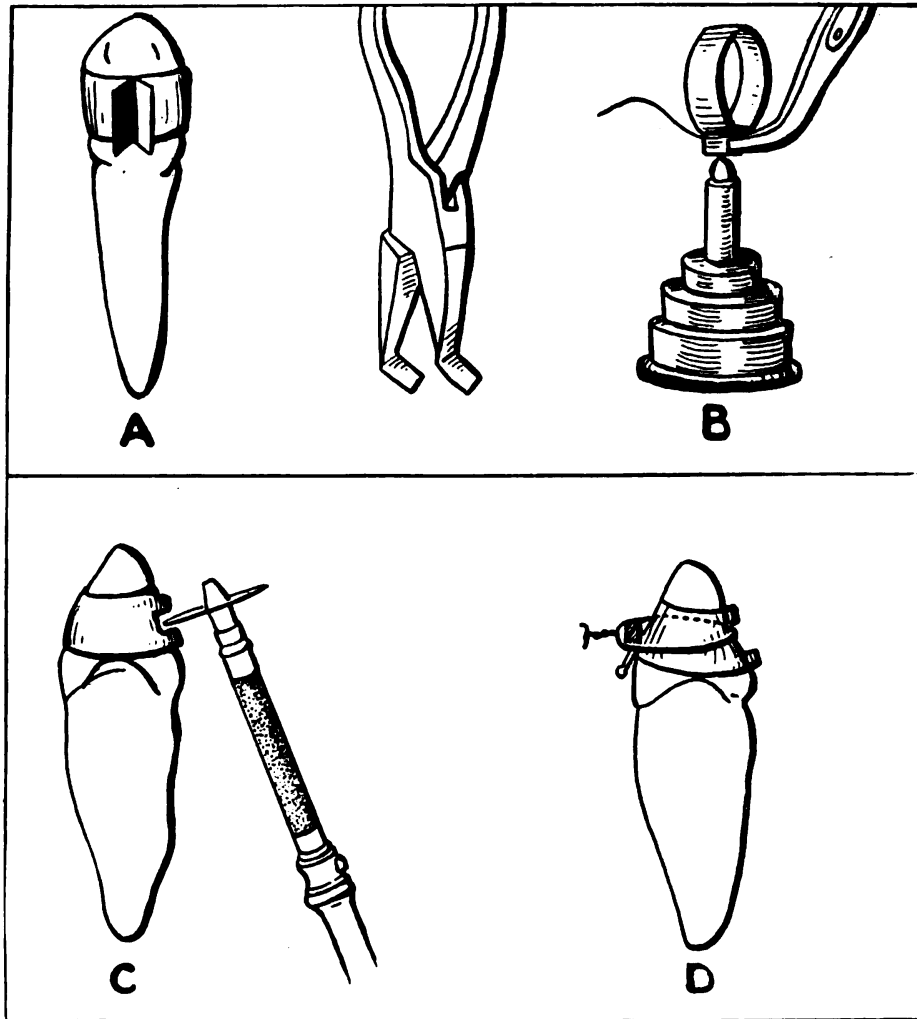
1. Surgery setup for the dental office. Portable operating table is used.

Dental tray.—The round dental tray is replaced by a large tray, 22 by 15 inches (borrowed from the galley), which will hold all the instruments required for most surgery.

Autoclaved packs.—Autoclaved packs containing six large hand towels, three pairs of rubber gloves, and a gauze bag of talcum powder are always kept available. This auxiliary operating setup could be used if the hospital were destroyed.

MAXILLOFACIAL SURGERY

On the return voyage the ship evacuates casualties. Maxillo-facial cases are referred to the dental department. If the action has been particularly heavy, many patients will have had only preliminary treatment. A complete roentgenographic examination is made and the case is diagnosed. Shattered teeth and shell fragments are removed; reduction is completed, and the area is immobilized. Sometimes only a few teeth remain, but usually the molars and cuspids are unharmed. To secure adequate fixation for these teeth, the following procedure is employed:



Naval Medical School 1944

2. Construction of orthodontic pinch band for fractures. See text.

1. Orthodontic band material, .004 by $\frac{1}{8}$ inch, is carried around the crown and pinched tightly on the labial surface—A.

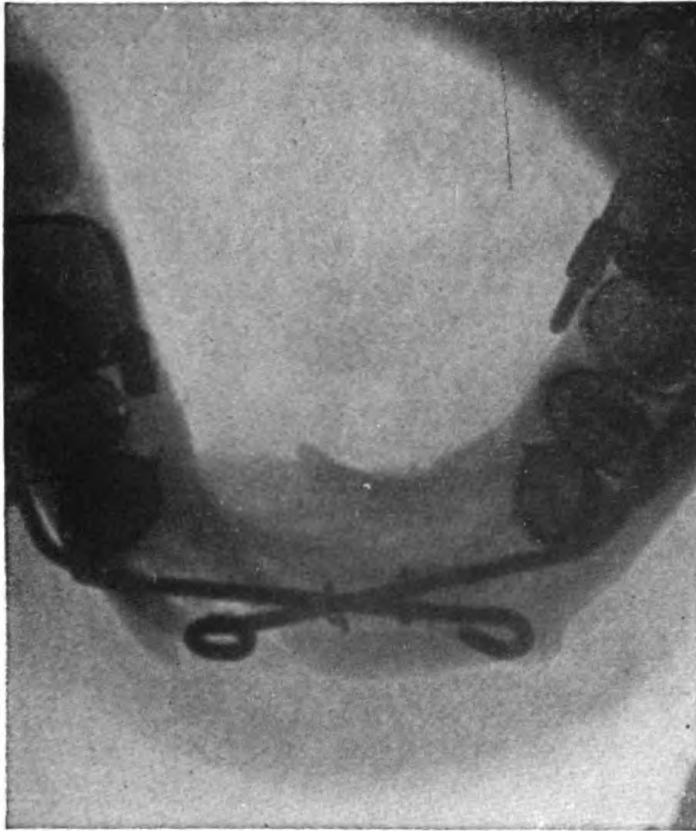
2. The pinch lap is soldered over the alcohol flame with 28 gage 14K gold wire solder, borax being used as a flux—B.

3. The band is then readapted to the tooth with the lap on the lingual surface.

4. A notch is cut in the pinch lap to receive the ligature wire—C.

5. The arch bar is secured with ligature running through the lingual notch—D.

Bands cemented on a few strategically located teeth in each arch will prevent arch bar ligatures from drifting apically and destroying periodontal membrane fibers (fig. 3.). This is especially true in fractures of the maxilla requiring superior traction with a head cap appliance for anchorage.



3. Occlusal roentgenogram showing a split labial arch wire engaged in buccal tubes on angle molar bands and ligated to orthodontic pinch bands. This appliance utilizes reciprocal traction by means of elastics to obtain a bilateral movement of the telescoped mandibular segments.

The mouth or face is so torn in some cases that impression-taking or intra-oral adaptation of arch bars is exceedingly painful if not altogether contraindicated. Soft radio solder wire used as a template has solved this problem:

1. The soft wire is first cut to the desired length.

2. The wire is molded around the dental arch and carefully removed.

3. The contoured wire is traced on paper with a soft lead pencil.
4. The arch bar is adapted in length and shape to this tracing.
5. Variations in the horizontal plane are copied by contouring the arch bar to duplicate the soft wire template.

Arch bars when placed and ligated should be passive. No stress should be exerted on any tooth or it will move out of the line of occlusion and the force of the inclined planes will prevent complete reduction and result in traumatic occlusion.

CONCLUSIONS

The dental officer attached to a troop evacuation ship should be prepared to handle the dental sick call of 75,000 or more troops a year. He must also be prepared to start or continue treatment in cases requiring maxillofacial surgery.



SULFUR AND FUNGI

The superficial fungus infections of the skin take place within or on the keratin layer. It is well known that keratin and related products serve well for the growth of fungi; thus, they are found growing on feathers and leather. Keratin is rich in sulfur-containing amino acids, and this raises the question of the relation of this element to fungus growth. If the sulfur is a requirement for the thriving of fungi, it must be present in such a form as not to lead to the production of sulfides. It also has been found that fungi are extremely sensitive to hydrogen sulfide and are killed or prevented from growing by extremely small concentrations.—CORNBLEET, T., and MEYER, E.: Sweat as culture medium for fungi. *New England J. Med.* 230: 604-607, May 18, 1944.



CHANGES AFTER RECOVERY FROM EPIDEMIC HEPATITIS

Only a small fraction of the cases of epidemic hepatitis terminate in death. The great majority of patients make a clinical recovery that is complete and apparently permanent. Whether in these recovered cases the liver is fully restored to a normal condition, or whether, on the contrary, there is residual damage or even progressive pathologic changes has been investigated.

The structure of the liver was studied in 14 cases after recovery from epidemic hepatitis. From 1 week to 14 months after the attack, these livers became available for examination as the result of fatal accident or unrelated disease.

Grossly all livers appeared entirely normal. Microscopically the appearance varied somewhat with the elapsed time since recovery, but in every instance the integrity of all liver lobules was preserved.—LUCKÉ, B.: Structure of liver after recovery from epidemic hepatitis. *Am. J. Path.* 20: 595-620, May 1944.

EIGHTEEN MONTHS ON AN ATTACK TRANSPORT

HARRY D. VICKERS
Lieutenant (MC) U.S.N.R.

The primary purpose of this paper is to review the routine medical work and the occasional surgical treatment of battle casualties aboard an attack transport in order that the medical personnel in the services may be better acquainted with the problems encountered in amphibious warfare. The second purpose is to point out the mistakes made and the lessons learned in the treatment of casualties during five major amphibious operations, and to indicate the advantages of certain methods of treatment which have given good results.

It is hoped that this will correct in part an erroneous impression prevalent among many physicians that war offers a wonderful opportunity for surgical training and a means to practice technical surgical operations.

The little medical work that occurs from day to day aboard ship is usually trivial and uninteresting, and when casualties are received aboard the discerning surgeon directs his energies to the saving of life and the prevention of disability on a wholesale basis, rather than the performance of a few brilliantly technical operations.

The ship on which these activities occurred was formerly a large passenger liner. The space assigned to the medical department consists of the following: Treatment room, dental office, pharmacy, record and medical office, operating room with adjoining scrub and sterilizing spaces, a 22-bed ward, a 2-bed detention room, and a 4-bed isolation ward. Troop officer rooms and troop areas are taken over as additional space is required, so that a large number of bed and ambulatory patients can be accommodated.

The operating room facilities compare favorably to those of a small general hospital. The space is adequate to run two operating tables, and is well-lighted and ventilated. It is equipped with a complete and modern array of surgical instruments and accessories. A portable x-ray and dental unit are available for roentgenography.

Secondary and emergency operating room space is provided by a large troop messroom forward of the main sickbay area. Mess tables, sliding on vertical stanchions, make excellent work space. There is a large space for auxiliary cots, an emergency water supply, auxiliary light and power, and adequate stores and supplies. An after battle dressing station is complete with supplies and

equipment for emergency use in the event of battle damage to the other areas.

The ship has traveled 75,983 miles during this 18-month period, operating from both the east and west coasts of the United States. It has visited many places in the Pacific from New Zealand to Alaska.

The routine medical work aboard ship is about what one would expect in caring for any healthy vigorous group of young men. Half the number of medical officers usually assigned to the ship could easily handle all the ordinary duties. However, while the ship is overstaffed for routine medical work, it is undercomplemented for the large scale casualty treatment incident to landing operations.

TABLE 1.—*Admissions to sickbay*

Medical diagnoses	No. cases	Surgical diagnoses	No. cases
Appendicitis, acute.....	24	Burns, 2d 3d-degree.....	9
Ulcer, peptic.....	11	Fractures, simple.....	15
Tonsillitis, acute.....	26	Heat exhaustion.....	4
Nephritis, acute.....	3	Fracture, dorsal vertebra.....	2
Meningitis, cerebrospinal.....	2	Fracture, lumbar vertebra.....	2
Measles.....	18	Sprain, sacroiliac.....	5
Mumps.....	6		
Pneumonia, lobar.....	7	Operations	
Catarrhal fever, acute.....	161	Appendectomy.....	11
Filariasis.....	1	Circumcision.....	37
Malaria, benign tertian.....	81	Herniorrhaphy, inguinal.....	6
Tuberculosis, pulmonary.....	2	Tonsillectomy.....	16
Gonococcus infection, urethra.....	18	Excision pilonidal cyst.....	3
Jaundice, acute infectious.....	2		
Mental disease (passengers).....	14		
Seasickness (severe).....	9		
Fungus infection, feet.....	11		
Cyst, pilonidal.....	3		

Table 1 which covers the period from 1 January 1943 through 31 December 1943 will serve to illustrate the average range of routine shipboard medical practice, the types of cases seen, and the relative frequency of their occurrence. It is by no means a complete list of all admissions, nor does it include those who were seen in the treatment rooms with ambulatory ailments and minor surgical complaints.

It would seem from the table that the ideal medical department for a ship would consist of an eye, ear, nose and throat specialist, a dermatologist, a psychiatrist, and a surgeon. The medical personnel should be augmented by the addition of more surgeons when a landing operation is anticipated. However the services of the above-named specialists should, if possible, be available in each division of ships.

There have been no deaths of crew or passenger personnel from illness or accident in these 18 months. In general, convalescence and recovery have been rapid and complete. The number of admis-

sions to the sickbay might seem rather high, but many of the respiratory infections were admitted as much for isolation of the patient as for treatment.

All elective surgery possible has been done aboard ship, except when convalescence would conflict with a combat mission. This has provided training for the corpsmen, practice for the surgeon, and a quicker return to duty for the patient. It has also helped to relieve the patient load in shore hospitals.

Steel wire suture material has been used routinely on this ship for all surgical procedures. A few exceptions have been made for such operations as circumcision. This material has many advantages by virtue of being nonabsorbable, nonelectrolytic, nonmagnetic, and nonallergic. It is well tolerated by every tissue of the body, and can be used as a single universal suture material. It is the ideal suture for use in the presence of infection, since it cannot harbor or act as a focus for bacterial growth.

Tissues tolerate steel wire sutures without demonstrable reaction, and heal without edema, thickening, or infiltration. Steel sutures are easy to work, and tying the knots with a needle holder permits a rapid, accurate, and precise technic.

Fewer sutures are necessary with this material than any other, since they are permanent, and their holding power constant and secure. There is an absence of delayed tissue or suture swelling, with resulting tissue strangulation, necrosis, and wound dehiscence. It is easily and absolutely sterilizable, and is well adapted to chemical sterilization which is often necessary under battle conditions.

Appendectomy and herniorrhaphy patients have been out of bed routinely on the first postoperative day. The advantages of such early ambulation are many: Pulmonary and peripheral vascular complications are minimized, the patient is able to take care of himself in the shortest possible time so that he needs no help in the event of a serious action, the loss of muscular tone is reduced to a minimum, and the morale of the patient does not have a chance to slacken.

The most important factor in early ambulation is that manpower is relatively increased. It is conceivable that early ambulation in the case of certain key personnel might, under unusual circumstances, mean the difference between a successful naval operation and a disaster.

There have been no instances of incisional weakness, recurrence of hernias, or other complications in any of these cases. Local infiltration anesthesia has been the procedure of choice in minor surgery, and spinal anesthesia in the major operations. There have

been no untoward reactions using spinal anesthesia, even when the ship has been rolling and pitching in heavy seas.

The most interesting periods, medically speaking, have been those when casualties have been received aboard. The ship has played an active part in the amphibious assault landings in Africa, and the North and Central Pacific areas. A few notes describing the different actions from a medical point of view will indicate the different types of casualties encountered, the trends of treatment, and the special problems resulting from unusual climatic conditions.

AFRICA

The casualties received aboard this ship during this action, the first amphibious assault of its kind, numbered only 29, but their wounds were rather severe, having been caused by relatively large caliber bullets. There were 3 compound fractures, 5 superficial wounds, and 19 extensive wounds of which 16 involved the extremities. After a modified debridement 50 percent of those wounds were sutured. Although the results observed over a period of 2 weeks were satisfactory, such treatment was in marked contrast to that of subsequent operations. The highest percentage of sutured wounds in any other campaign has been 3 percent.

It was decided on the trip across that if opportunity presented refrigeration treatment of severe extremity wounds would be tried. It was thought that icing would accomplish the following: (1) Control infection and its spread; (2) prevent the absorption of toxic bacterial and metabolic products; (3) tide a patient with a serious wound over the period during which his general condition would not permit the performance of major definitive treatment; (4) permit a delay of surgery on those patients with mutilating wounds at a time when other surgical emergencies presented more pressing demands; and (5) effect the anesthesia under which the final surgery could be done.

Ammunition boxes with the ends knocked out were used as refrigerating chambers. A rubber sheet was laid in the box, and the extremity placed in the sheet and surrounded with cracked ice. The upper end of the sheet was taped loosely to the skin with an Es-march bandage. The other end of the sheet was gathered in a trough to carry off the water.

This treatment was used with excellent results on one casualty who had a severe mutilating wound of the leg with destruction of the popliteal vessels. The leg was encased in ice to the mid thigh as soon as it was apparent that it was becoming gangrenous. There was an almost immediate improvement in the general condition of

the patient; he had much less pain, his temperature and pulse came down to basal levels, and his appetite for food and tobacco returned.

The leg was kept in ice for 5 days. This time was used to restore the patient's blood balance by repeated transfusions. On the fifth day a guillotine amputation was done through the mid thigh. A low spinal anesthesia had to be used to supplement the refrigeration, which was not adequate because no tourniquet had been used. The patient's convalescence was uneventful, and healing of the wound progressed in an apparently normal manner.

ALEUTIANS

Every person on these islands was exposed to the effects of a dismal, cold, wet, foggy climate, so that it is interesting that only 10 patients were admitted suffering from exposure only. They were soaking wet, cold, uncomfortable but not in pain, shivering, mentally alert, clumsy in their efforts to help undress, and gratefully relieved to be off the beach and aboard a warm ship. Hot soup, a drink of whiskey, and rest in a warm dry bed sufficed to effect a rapid recovery in every case.

Initial temperatures, while inaccurate in most cases, failed to record a reading less than 96° F. All patients were classed as recovered in 24 hours. There were no upper respiratory infections in these cases, nor were there any in the group at large. Pneumonia, either as a primary entity or as a complication, was not observed in the Aleutian area.

Almost every one of the 113 casualties received aboard during the first landing in this area was suffering from some degree of exposure to the cold weather. Not a few of the seriously wounded had lain in cold foxholes, wet to the skin, for periods of 2 to 4 days, yet they survived both the effects of the cold and their wounds.

In most cases the patients' dressings were wet and muddy, and the skin surrounding their wounds was cold, clammy and pale. However there was a striking absence of any infection or evidence of inflammation. There was a minimal amount of swelling, discoloration, hemorrhage and pain. The wounds, in most cases, were covered over with a flat, clean, leathery clot. There was almost no deep tissue swelling or tension in any of the wounds.

The course of these patients aboard ship was smooth. Almost all, except the more serious cases, were ambulatory from the first day. A mild febrile reaction, averaging about 101° F., was the rule for about 36 hours, after which the temperatures were normal. There were only 5 patients with temperatures above normal on the eighth day, and the highest of these was 100.2° F.

Whether this amazing absence of infection was due to the meth-

ods of treatment, intensive sulfonamide medication, an absence of soil contamination, or to the natural cryotherapy given by the climate, is a question difficult to answer. The behavior of these wounds was in such sharp contrast to those we later observed in other climates that it is our opinion that the exposure to the cold may have been beneficial to these wounds.

This observation is in line with current thoughts on refrigeration therapy, and suggests that further application of this principle of tissue cooling be applied to fresh wounds in temperate and tropical climates.

The troop surgeons and aid men did heroic and untiring work in the field. They wisely did little for their patients except administer a Syrette—often through the clothing, apply a battle dressing—often over the clothed wound, and then themselves carry the wounded to the rear. This seemingly rough first-aid treatment was intelligently done, since the patients were not further chilled by unnecessary exposure to the cold and further shocked by nondefinitive manipulation. Many lives were undoubtedly saved by the wise decision not to try to do too much on those muddy wastes.

A simplified method of wound treatment was put in effect during this operation with excellent results. It is so simple that the care of minor wounds was entrusted to selected corpsmen. To popularize the method and sloganize the details in their minds, it has been phrased the "Cut-Pack-Plaster" treatment.

A local anesthetic is injected around the area through the wound edges and a few millimeters of the seminecrotic skin is *cut* out with a scalpel or sharp scissors. It is felt that this damaged skin is low in resistance, precontaminated, and is a potential source of infection. This incision is then carried above and below the wound a sufficient distance to effect an adequate gutter into the area of deep tissue destruction and contusion.

This step facilitates visual exploration of the wound, and provides a wide avenue for drainage. Foreign bodies, pieces of shell fragment and gross dirt are removed only if seen in the wound. The mutilation of block excision debridement is not only unnecessary but distinctly harmful and is not done.

The wound is lightly and loosely packed with a sulfonamide-petrolatum gauze extending into the deepest pockets and crevices. A single gauze is placed over the wound and a light circular *plaster* bandage applied. The plaster bandage serves to support the damaged soft tissues, splint the adjacent joints if this is desirable, absorb secretion, and promote quiet restful healing.

This procedure is simple, easy, rapid, well tolerated by the patient, entails a minimum of equipment and personnel, avoids major

anesthetic problems, conserves tissues, insures drainage, prevents accumulation of exudate in the deep tissues, avoids secondary infections during redressings, builds a clean granulating area, and makes the wound safe and relatively painless. A sketch of the wound penciled on the plaster effects a finished treatment that does not invite daily inspection and redressing.

All compound extremity fractures were treated by the closed plaster method, after preliminary enlargement and treatment of the wounds as above. No wounds were sutured. Fractures of the humerus, most of which were associated with considerable loss of tissue and bone substance, were treated with a light hanging plaster splint. Five of the seven patients were ambulatory after the first day.

Penetrating wounds of the chest were managed conservatively, except that the wounds of entrance and exit were excised and loosely approximated with steel sutures. This was done to exclude a focus in which infection might develop and spread within the chest. Aspiration was done when indicated, without air replacement.

Three passengers with 10-day-old third-degree body burns were treated with cool sea water tub baths twice daily. This proved to be an excellent general tonic and stimulant, was very effective in removing loose slough and secretions, and rapidly built up a clean granulating base.

A second amphibious landing in the Aleutian area resulted in much less medical work, although there were 73 nonbattle and 22 battle casualties. A majority of the nonbattle casualties were cases of exposure and immersion foot. The latter were treated by rest, elevation, and mechanical fanning with cool air.

Whole blood and plasma specific gravity determinations were used as a basis for intravenous therapy with good results in a casualty with an abdominal wound. It was life-saving in this instance in that it indicated accurately the exact fluids needed to balance the patient's parenteral requirements of whole blood, plasma, and saline. The method used was found to be reasonably accurate, simple, and within the limitations of the ship's laboratory.

In this connection it is worthy of note that our corpsmen are trained to give intravenous fluids and transfusions. The latter are given entirely without the help of a medical officer, from the preliminary cross-matching, to the observation of the patient for reactions.

CENTRAL PACIFIC

Climatic conditions again bore a decided influence on the wounded, since the scene of this operation was in the tropics. The

average atmospheric temperature was excessively high, and in sharp contrast to that prevailing in the Aleutian area.

Some degree of dehydration was seen in each of the 103 casualties received aboard, and was severe enough to contribute to rather profound shock in the more seriously wounded. Hydration was necessary before any surgical treatment could be given to a great many of those with serious wounds. A considerable number of the men suffered from the effects of exposure to the sun, and two casualties were rather extensively, though not severely, sunburned. Many of the officers and men who returned to the ship after spending several days ashore suffered from herpes simplex of the lips.

Most of the wounded were seen aboard ship within a 12- to 24-hour period, but their wounds had had ample opportunity to become heavily contaminated with dirt and coral sand. Many of the wounded continued to fight in spite of their injuries, and some of these did not receive treatment for several days.

Shock in the severe cases was the rule, and it was necessary to use liberal amounts of plasma and whole blood to combat it. The less seriously wounded who were in mild shock responded promptly to morphine, rest and reassurance. Blood specific gravity determinations indicated that one patient had been given too much plasma both on the beach and aboard ship, but the administration of a liter of whole blood restored the clinical and laboratory balance.

A great many of the wounds were seen to be already infected on admission. Most of the shell fragment wounds were grossly infected, but cleared up under drainage, sulfonamide medication, and immobilization. There was only one serious infection in the 72 patients aboard 20 days later, and that was in a destructive compound fracture of the elbow joint.

The wounds were, as a whole, rather severe and extensive. There were relatively few caused by small caliber bullets passing cleanly through soft tissue. There was a preponderance of fragment wounds, and these as a type were either multiple pepperings with small particles, or large, rough, destructive lacerations. There were five patients who were peppered from head to foot, but who required no treatment other than a few band-aid dressings.

Foreign bodies were not, as a rule, removed unless they were visible in the wound or palpable under the skin. Several pieces of shell fragment were removed from the subcutaneous tissues in the succeeding days, either having escaped notice at the time of the original treatment or becoming palpable after migration to a superficial position.

Debridement in the sense of a block wound excision was not done, although in a few cases small wounds were trimmed and loosely

closed, hoping for an improved cosmetic result. Even these wounds, however, were not closed tightly, but were allowed to gape so that secretions could escape. A few of the large wounds were matted loosely with steel sutures in order to reduce the size of a large defect, but closure was not complete, sulfonamide-petrolatum gauze being inserted between the sutures. In general, all the wounds were packed wide open with gauze and covered with plaster bandages.

The plaster bandages and splints soon became saturated with secretions and blood and, probably because of the heat, became very offensive. It was mainly on this account that most were changed during the second week. Maggots appeared beneath the cast of one patient but no ill effects, other than the mental discomfort of the patient, resulted. All of the wounds at this time appeared beefy-red, and a clean granular bed had formed.

A plaster skull-cap bandage was applied to a treated intracranial injury with good results. It seemed to protect the wound and head as the patient thrashed in bed, and made his care easier, the bandage staying firmly and securely in place.

Tetanus toxoid, 0.5 cc., was given to every casualty on admission, and sulfathiazole therapy started. This drug was given in 1-gm. doses every 4 hours, due care being taken to insure an adequate urinary output. The serious cases, and those unable to take the drug by mouth, were given 3 gm. of sodium sulfathiazole intravenously on admission, and 1 gm. repeated every 8 hours. There were no unfavorable reactions to these drugs in this or other operations.

One patient who had a severe compound fracture of the humerus gave a history of sensitivity to the sulfonamide drugs, so they were withheld in his case. It is interesting to note that he did not develop an infection, reacted very well to the treatment from the very first, and was ambulatory the whole time he was aboard ship.

The 94 American casualties received in the initial phase of the second amphibious landing assault in the Central Pacific area in which this ship participated were healthy well-nourished young men. Their wounds, although severe, were clean, uninfected, and still had a healthy beefy color, since they were received aboard ship in a relatively short time after having suffered their injuries. They were untreated except for those first-aid measures which were given at the scene of combat or on the beach.

The Korean and Japanese wounded, numbering 48, who were received in the second phase of this same operation were by contrast poorly nourished, dirty, dehydrated and weakened. The majority of their wounds had been treated or dressed on the beach,

but they must have been contaminated and infected before that treatment, since almost all of the wounds were purulent, and the burn cases covered with large patches of gray slough.

The contrast between the fresh and the old, the clean and the dirty, the strong and the weak, was very evident, and it seemed that we passed abruptly from the treatment of one type of battle wound to the care of an entirely new and different sort of casualty.

This was a dramatic illustration that there is a direct relationship between the appearance of a wound, its potential of infection, sometimes the actual mortality, and the length of time which has elapsed from the wounding of the patient to his treatment aboard ship. This is especially true in the tropics.

The type of wound encountered in the initial phase was that to which we were accustomed, and the usual definitive treatment was applied with confidence of good results.

The type of wound seen in the prisoner-of-war patients was a different matter. In all probability a considerable time elapsed from their being wounded until they were literally pried out of their holes with the point of a bayonet, a sufficient time to permit the development of a full-blown infection. A few of these wounds had been widely debrided with apparently good results, although with considerable loss of blood and destruction of tissue which might later have proved viable and functional. In the majority of cases the wounds had not been touched, except to apply a vaseline gauze dressing.

Almost without exception their dressings were loose, dirty, wet and soiled by the time they arrived aboard ship, so that it was necessary and desirable to change them, not only for cleanliness, but also that we might know the kind and extent of their wounds and what treatment had been given.

A plaster dressing, if properly applied, would not have slipped, loosened, or have become so soiled, and would have served notice to us that a definitive treatment had been given, and from the sketch penciled on the plaster we would have known the type and extent of the wound beneath. As we were not able to converse with these patients, a picture would have been worth a thousand words (as their Chinese enemies have said)—a picture in this instance on a plaster dressing.

There were a great many second- and third-degree burns. These were received covered with simple vaseline dressings, which were either not disturbed, or if in need of replacement were renewed with the same material, and covered by a final plaster bandage. Fortunately, the slough in the majority of these cases was dry and escharotic.

At least one case of beriberi was detected in the Korean laborers, which was a further indication of their general state of nutrition. The only case of tetanus that we have seen developed in a Japanese who had a severe gunshot wound of the thigh and multiple burns. Our inability to converse with this patient prevented our making the diagnosis promptly and generally complicated his care.

It is a very dangerous practice to accept a patient's word about the severity of his wound, or assume that wounds are superficial merely because they appear to be. An American casualty was brought aboard with the history of having fallen on the point of a bayonet. There was a small laceration in the left inguinal region, but the patient emphatically stated that the point had only penetrated about $\frac{1}{2}$ inch. It was not explored on this account, but merely dressed. Later in the day signs of an internal hemorrhage prompted a further exploration and it was found that the bayonet had actually impaled itself to the hilt, and had caused a laceration of the descending mesocolon.

A prisoner of war with an apparently insignificant wound of the buttock expired suddenly the day after admission. A postmortem examination revealed that the shell fragment had torn itself to a final site in the lesser omental sac. An infection had caused a profuse secondary hemorrhage and death.

The converse is also true, fortunately, and wounds which appear to be mortal turn out, on examination, to be easily and simply treated. An American soldier was admitted with an extremely destructive fragment wound of the right upper abdominal quadrant which had opened a large rent into the peritoneal cavity. Exploration, under local anesthesia, failed to reveal any visceral damage, and a modified through-and-through closure with steel sutures, with strip-gauze drainage to the fascial spaces, was done with surprising ease. His course while aboard ship was entirely smooth.

Compound fractures of the femur were handled in the following manner: The wound was treated as any other, by trimming the skin edges and packing its depths with gauze. A Steinmann pin was driven through the tibial tubercle, the limb suspended and aligned, and an unpadded circular plaster splint, incorporating the pin, applied from the toes to the groin. The alignment and length were carefully maintained during the hardening of the plaster, after which the entire plaster splinted limb was placed in a Thomas splint. Supporting strips of wide crinoline secured the plaster splinted limb to the side rods, and traction was applied to the Steinmann pin from the Thomas splint end bar.

No difficulty was encountered in obtaining the proper length in any of those cases, since the thigh muscles seemed to be in a state

of local shock as a result of the impact of the missile and had temporarily lost their tone. This effect seemed increased by spinal anesthesia.

This method eliminated all the ropes, pulleys and weights which so often clutter up the fracture bed, and which would have been a disastrous hazard in the event of a serious accident to the ship. This arrangement met all the demands for maintenance of alignment, traction-countertraction, and tissue immobilization.

A blood bank of 3,000 cc. was built up the day before the landings, and later proved very valuable and time-saving. It expedited the administration of whole blood, and had a serious emergency arisen, might have proved life-saving. No reaction was noted in its use.

Cryotherapy was used with good results on two cases to control and limit infection and gangrene. It provided the anesthesia for later amputations, with excellent success in one instance, but with only partial success in the other. The latter was directly due to a faultily applied tourniquet which allowed circulation to the distally iced tissues.

An American soldier was admitted with a compound fracture of the mandible which resulted in a massive hematoma and swelling of the sublingual tissues. A deep stab incision was made into the area to relieve the tissue tension and effect drainage. In spite of a ready tracheotomy setup and a medical officer's presence, the patient suddenly expired of an acute edema of the glottis 12 hours later. Had a tracheotomy been performed at the time of his original treatment, this man's life probably would have been saved.

The results of treatment of penetrating wounds of the abdomen have been very disappointing, probably because the majority of cases have been seen after considerable delay. One patient, however, survived after lying in a cold foxhole in the Aleutian area for 4 days. The mortality of intra-abdominal wounds for these five operations was 50 percent. Laparotomy was performed on 9 of the 12 cases, with 5 surviving. The operative mortality was 44 percent. Of the 3 patients treated conservatively only 1 survived.

Conservative treatment seems indicated only in those patients seen after 12 to 18 hours in hot climates, and who have wounds which, in the opinion of the surgeon, might seal over or localize within the peritoneal cavity.

MANAGEMENT OF FUNGUS INFECTION OF THE FEET

FRANK GLAUSER

Lieutenant Commander (MC) U.S.N.R.

Fungus infection of the feet (athlete's foot) had been an unusually major problem in the sickbay at this Navy yard. The treatment which had been used was potassium permanganate 1:9,000 soaks and a fungus paint of salicylic acid 5-percent in tincture of merthiolate.

In the series here presented the men were issued sulfur sublimate, later changed to precipitated sulfur which is listed in the Navy Supply Catalog. There was no apparent difference in the action of the two. Instructions were given to rub the affected parts generously with the powder, night and morning.

Two hundred forty-seven patients were successfully treated over a 6-month period. These were divided into the following groups:

1. Those who were cured with the sulfur alone. The majority were cured with one box (approximately 30 gm.) of powder.

2. Those who received potassium permanganate 1:9,000 soaks for 1 hour, followed by the application of sulfur.

3. Those on whom fungus paint and sulfur were used. They were largely for try-out purposes only.

4. Those most extensive cases, particularly the deep seated ones, where the infection had burrowed between the layers of the skin. Copper ionization treatment was used according to the method described by Haggard, Strauss and Greenberg¹.

5. Those patients who developed a complicating secondary purulent infection with lymphangitis, requiring hospitalization.

TABLE 1.—*Summary of cases and treatment*

Group	Treatment	No. cases	Percent total	No. cured	Percent cured	Av. visit to sickbay
1	Sulfur.....	212	85.8	193	90.6	3
2	KMn O ₄ and sulfur.....	21	6.5	16	76.2	4
3	Fungus paint and sulfur.....	29	8.5	26	89.9	5
4	Copper ionization.....	10	4.05	9	10.0	5
5	Hospitalized.....	3	1.2	3	100.00	—

Those patients not too far advanced, constituting 85.5 percent of the total of 275, were treated with sulfur alone. Many returned

¹ HAGGARD, H. W.; STRAUSS, M. J.; and GREENBERG, L. A.: Fungous infections of hands and feet treated by iontophoresis of copper; preliminary report. J.A.M.A. 112: 1229-1232, April 1, 1939.

for additional powder, averaging 3 sickbay visits. Of these 90 percent were cured; 19 patients required further treatment. Of these 17 were given potassium permanganate soaks, followed by sulfur and 2 were referred directly for copper ionization.

The 76.2 percent cured with potassium permanganate soaks and sulfur represents the results on the more advanced cases. Three of these had to be referred later for copper ionization. One was transferred during treatment before the results could be noted and one developed lymphangitis and required hospitalization.

The 29 patients treated with fungus paint and sulfur showed 89.9 percent cure. Two were given potassium permanganate soaks and one was referred for copper ionization. It is doubtful if the additional use of fungus paint made much difference in the final results.

Of the 10 patients that received copper ionization 4 were referred primarily, the other 6 having received the other methods which failed to cure. These cases, of course, were the most advanced ones, many being associated with considerable hyperhidrosis. One of these patients went AOL after 4 treatments, thus the 90 percent figure. These treatments were all carried out in the physiotherapy department of the main dispensary.

Only 1 of the 3 patients sent to the hospital had been under treatment at the sickbay. This man had been treated at irregular intervals 5 times in 4 weeks, during which time the infection had cleared up and broken out again. He had received potassium permanganate soaks and sulfur twice, but like the other two developed lymphangitis of the leg, with fever. Treatment at the hospital consisted of sulfathiazole orally and hot magnesium sulfate dressings until the infection disappeared. This was followed by application of dilute aluminum acetate and boric acid solution to the infected toes. All patients were discharged from the hospital cured.

SUMMARY

A series of 275 patients with clinically evident fungus infection of the feet were treated in the sickbay over a period of 6 months. The great majority responded to a simple application of sulfur, either sublimed or precipitated. Those who did not respond were treated with potassium permanganate soaks followed by sulfur. Salicylic acid 5 percent in tincture of merthiolate followed by the sulfur was used on a small group as a try-out with results which did not differ from those obtained with the powder alone. The most refractory cases received copper ionization with excellent results. Three patients were hospitalized for complicating lymphangitis.

CLINICAL NOTES

AMEBIASIS AS CAUSE OF RECURRENT ABDOMINAL PAIN

REPORT OF CASES

LEON J. TAUBENHAUS

Lieutenant Commander (MC) U.S.N.R.

The patient complaining of recurrent abdominal pain often presents a problem in diagnosis, treatment, and, in the military services, one of disposition. These patients are frequent visitors to the sickbay, complaining primarily of recurrent abdominal pains, sometimes but not always associated with diarrhea.

Physical findings in these cases vary from an absence of physical signs to tenderness over part of the colon. Blood study findings vary from a normal count to a leukocytosis of 20,000. Some of these patients appear ill and others seem perfectly well. Repeated stool examinations are negative for ova and parasites. Some cases are eventually diagnosed as appendicitis and the appendix is removed, but the patient invariably returns with a recurrence of his symptoms. In addition to the abdominal symptoms many complain of tiring easily or of weakness, and often they are dismissed as neurotics or malingerers.

During the past 6 months at several Naval dispensaries routine proctosigmoidoscopic examinations were made on all patients complaining of recurrent abdominal pain of any kind except those in whom a definite diagnosis of acute appendicitis or peptic ulcer could be established. In a very large number of these cases a diagnosis of amebiasis was established.

At first five stool examinations were made prior to proctosigmoidoscopy, but later the routine stool examinations were omitted as it was felt that unless the stool is examined by a competent parasitologist, the relatively small numbers of the amebae or cysts are too often missed. It was further felt that proctosigmoidoscopy was sufficient to establish the diagnosis.

The sigmoidoscopic appearance of the amebic lesion varies from minute, red, punctate ulcers, not undermined, which appear as pin pricks in the mucosa, to the typical, larger, irregular, undermined amebic ulcers with a dirty necrotic base. Under direct vision scrapings are made from the edges of the ulcers, suspended in

physiologic saline solution and examined microscopically while still fresh for active forms of *Entamoeba histolytica*. If none is found, a second specimen collected at the same time is stained with D'Antoni's solution and examined for cysts. The majority of the amebic lesions were found on the rectal valves or on the anterior rectal wall distal to the lowest valve.

The minute, punctate type of lesions, no larger than pin pricks, can easily be overlooked if the examiner does not bear them in mind. They are best seen as the speculum is being inserted because if the mucosa is at all involved, it tends to bleed in the vicinity of these ulcers and they will be misdiagnosed as sigmoidoscopic trauma.

In some of the cases examined the rectal mucosa had a granular appearance similar to that of early nonspecific ulcerative colitis. In others it appeared dry and atrophic. In some cases the mucosa was markedly injected and in others it appeared normal. Thus only by finding the actual amebic lesion containing either motile or cystic forms of *Entamoeba histolytica* can the diagnosis be established. An otherwise unhealthy appearing bowel wall does not rule out amebiasis, and in these cases, in the absence of the large classical ulcers, a careful search should be made for the punctate type of lesion. Cleaning the bowel thoroughly with a tap-water enema is sufficient preparation for proctosigmoidoscopy and is considered more satisfactory than other types of cleansing enemas.

The following typical cases are presented to illustrate the variety of symptoms as well as the common features of most cases.

CASE REPORTS

Case 1.—A sailor was transferred to this dispensary with a diagnosis of acute appendicitis. He was complaining of vague, but severe abdominal pain which he could not localize, and of diarrhea. The present attack began 36 hours previously with a rigor followed by diarrhea and pain. The patient stated that for the past year he had had frequent attacks of abdominal cramps and pain, associated at times with a watery diarrhea of moderate severity. At no time did he pass any blood by rectum, and only rarely any mucus.

Upon examination the patient appeared ill, uncomfortable, and anemic. The temperature was 99° F., the pulse rate 100, and respirations 20. The abdomen was slightly distended and soft; there was no rigidity or rebound tenderness. Marked tenderness, however, was elicited over the cecum and lower ascending colon. Proctosigmoidoscopy revealed the entire rectosigmoid to be involved, with scattered ulcers varying in size from that of a match-head to about 1½ inches in diameter. The ulcer edges were undermined and the base was dirty and necrotic. Scrapings contained many active motile forms of *E. histolytica*. Response to specific therapy was satisfactory.

Case 2.—A 31-year-old sailor complained that intermittently for the past 10 years he had suffered with vague abdominal pains. At no time were the pains associated with diarrhea or dysentery, but during the past 2 years the pains had become more severe and more frequent. He stated that recently he felt chronically tired, had frequent headaches, and was unable to perform his duties as well as he once could.

During a 2-week observation period five stool examinations yielded negative findings. Antispasmodics did not relieve his pain. Physical examination revealed only a mild tenderness over the left side of the colon. Proctosigmoidoscopy revealed the rectal mucosa to be dry, dull red in color and of a coarse, granular appearance. Scattered throughout the mucosa were small ulcers, about the size of match-heads, with indurated edges and dirty necrotic bases. Scrapings were positive for motile and cystic forms of *E. histolytica*. Specific therapy was instituted and 13 days later sigmoidoscopy was again performed. At this time marked improvement was noted in the appearance of the rectal mucosa. It was much less granular than before and now had a moist, pale pink appearance. The ulcers were decreased in size and improved in appearance. Scrapings were negative for amebae. The patient was asymptomatic and stated he felt better than he had felt in years. He was soon returned to duty under treatment.

Case 3.—A 21-year-old sailor complained of intermittent, crampy abdominal pains and severe diarrhea with moderately bloody stools, of 5 days' duration. The condition had become progressively worse. He also complained of malaise and generalized aches and pains.

On examination he appeared to be chronically ill. The only abnormal physical finding was tenderness on palpation of the sigmoid colon and splenic and hepatic flexures.

Proctosigmoidoscopic examination showed the mucosa to be moist and pale. Starting just distal to the lowest rectal valve and scattered upward were a few minute, punctate ulcers. These ulcers were pin-point size, not undermined, and their bases were clean. Mucosal scrapings were positive for motile forms of *E. histolytica*. The condition responded satisfactorily to specific therapy.

Case 4.—A 19-year-old sailor complained of recurrent attacks of vague, unlocalized abdominal pain, often associated with diarrhea, over a period of 10 years. All attacks were relatively mild and at no time did blood appear in the stools. During the past 6 months the patient had been hospitalized three times because of "gastro-enteritis." On each occasion the symptoms subsided with bed rest and symptomatic therapy, and he was returned to duty. During the past 3 months he noticed that he felt weak, and tired more easily. The present attack began 3 days prior to admission as generalized abdominal cramps which shifted after several hours to the right lower abdominal quadrant. There was diarrhea, nausea, and vomiting at the onset. The patient's temperature was 99° F. Examination revealed tenderness in the right lower quadrant of the abdomen but no rigidity.

Proctosigmoidoscopic examination disclosed a large irregular ulcer, about 1½ by 1 inch in size, on the anterior rectal wall about 1½ inches proximal to the anal aperture. The base of the ulcer had a dirty, necrotic appearance and the edges were undermined. There was also a clean, minute, punctate ulcer on the rim of the lowest rectal valve. Scrapings of the mucosa on both sites proved to be positive for cysts of *E. histolytica*. The response to specific therapy was favorable.

COMMENT

Contrary to a popular misconception, amebiasis is not a disease of tropical and subtropical locales. Although the cases cited in this report were seen in Naval dispensaries located in the South, the personnel involved came from all parts of the United States, and careful history elicited the fact that in most cases symptoms were present prior to enlistment in the Navy.

Although the symptoms varied considerably, in all cases except one (case 2) there was a history of diarrhea at some time during the course of the disease. The patients all complained of abdominal pain. In most cases the pain is recurrent, crampy, and difficult to localize. Most of these patients also complained of feeling tired or exhausted. The only constant physical sign was tenderness over some part of the colon. Only in cases with actual dysentery (case 3) was there any blood in the stool. Thus a history of recurrent abdominal pains, at some time associated with mild diarrhea and accompanied by tenderness on palpation of some part of the colon, should cause one to suspect amebiasis.

There was no correlation between the degree of rectal involvement as seen through the sigmoidoscope and the clinical picture. Some patients with mild symptoms had widespread rectal involvement, whereas the patient cited in case 3 who had an actual dysentery had only a few minute punctate ulcers. There does seem to be a relationship between the symptom complex and the finding of motile or cystic forms of *E. histolytica* in the scrapings from the ulcers. In those cases with the more severe diarrheas, motile amebae were present, while in those in which pain and not diarrhea was the outstanding symptom the cystic form predominated. It seems that the factor which determines whether the patient gets dysentery or the milder type of infestation, amebiasis, depends on the resistance of the host. Although in cases 2 and 4 symptoms had been present for 10 years, at no time was there actual dysentery, yet in case 3 symptoms were present for only 5 days and there was dysentery.

Probably any adequate specific therapeutic regime will suffice to cure these cases. In the cases mentioned here treatment consisted of a course of emetine followed by successive courses of carbarsone, vioform, and carbarsone again. Rest periods were given between each course of treatment, and in a few instances, as vioform was not immediately available, carbarsone was substituted. The patient was kept in bed while receiving emetine and allowed ambulatory privileges during the remainder of the treatment. When feasible the patients were discharged to duty under treatment during the latter half of the treatment period.

SUMMARY

1. Cases of atypical recurrent abdominal pain present a problem in diagnosis, treatment, and disposition of the patient unless a specific diagnosis can be established.

2. Routine proctosigmoidoscopic examination of all such patients seen at two Naval dispensaries revealed a large proportion to have ulceration of the colonic mucosa due to *E. histolytica*. With establishment of the correct diagnosis and the institution of adequate specific therapy these patients were returned to duty cured.

3. Although the symptoms of amebiasis are extremely variable, the combination of recurrent abdominal pain, mild diarrhea at some time during the course of the disease, and tenderness over some portion of the colon should lead one to suspect its presence.

4. Amebiasis is a separate clinical entity from amebic dysentery.

5. Proctosigmoidoscopy should be a routine diagnostic procedure in all cases of recurrent abdominal pain when no other definite diagnosis is obvious. Only in this way will amebiasis be detected.

6. This procedure is of added value to medical officers in the armed forces. Not only is it easy to perform, but it will establish a definite diagnosis of amebiasis promptly, thus allowing these men to return earlier to full duty and reducing the load of the sick calls.



DIAGNOSIS OF RECTAL CANCER

Digital examination is the most important single factor in the diagnosis of rectal cancer; in 90 per cent of this series the growth was palpable to the examining finger. Failure to make a digital examination was largely responsible for 40 per cent of the cases remaining undiagnosed for periods of one month or more. This procedure is diagnostic for lesions situated in the anus and ampulla and should never be omitted from a routine physical examination even in comparatively young patients. It may be necessary to perform the examination with the patient in several positions before the presence or absence of a tumor in the lower rectum can be determined. It is sometimes possible to feel a mass with the patient standing before the examiner in a half upright position, when the growth is not palpable in the recumbent position. If the knee-chest position is used for sigmoidoscopy, it is necessary to make the digital examination before so placing the patient, or frequently the tumor will not be felt. On occasion, the examination is made in all three positions.—McCORMICK, N. A.: Cancer of rectum. Radiology 42: 531-538, June 1944.

GONORRHEAL OPHTHALMIA

REPORT OF TWO CASES OF UNUSUAL ORIGIN

STIRLING S. McNAIR

Lieutenant Commander (MC) U.S.N.R.

Recently, while serving as ophthalmologist to a task force, the author had the opportunity of treating two cases of gonorrheal ophthalmia contracted during an amphibious operation.

These cases are being reported because of their unusual origin, from the use of binoculars, and the serious consequences resulting in the loss of an eye in one case and the serious damage in the other. These two men, one the commanding officer of an LST, and the other a signalman on the same ship, probably contracted the disease at the same time and their symptoms were of approximately the same degree when first seen. They had frequently used the same binoculars on the bridge, and as the ship was transporting troops into the combat area the binoculars had been used by many of the troops.

It is interesting that none of the crew or embarked troops had been ashore for 4 weeks prior to the appearance of the eye infections. All members of the crew were examined for gonorrheal urethral discharge and none were found positive. At that time it was impossible to examine the troops as they had debarked 1 day previous to the appearance of the initial symptoms.

It cannot be absolutely determined that the disease was contracted by the use of the binoculars, but by exclusion it seems to be the most likely mode of transmittal. The reasons for presuming that this was the means of transfer are: (1) History of unauthorized personnel using the binoculars daily from 3 weeks up until the day before the symptoms occurred; (2) neither of the two cases had a history of past or present infection by gonococci and all smears taken on the two men were negative; (3) two cases of gonococcus infection of the urethra were discovered in the troops while enroute to the operations area; (4) all members of the crew were given a thorough examination with negative results in all; (5) both men infected had used the binoculars many times daily in the performance of their duties and the infection occurred in the left eye and started at the same time in both patients; and (6) no other instrument or article except the binoculars is known to have been used by both men.

CASE REPORTS

Case 1.—The commanding officer of an LST, age 26, reported on the first day of symptoms to the group medical officer who referred the patient to the author the following day. When seen on the second day of the disease, the conjunctiva of the left eye was markedly injected with many subconjunctival hemorrhages under the bulbar and palpebral conjunctiva. There was pus of moderate consistency present, the cornea was clear, and there was moderate swelling of the upper lid.

On the third day of the disease there was fairly marked chemosis of the conjunctiva and the pus was considerably more profuse and thicker in consistency. Homatropine hydrobromide 4 percent was instilled. A smear was made at this time which showed gram-negative intra- and extracellular diplococci, but owing to the circumstances of battle and the difficulties of transportation, the officer was not contacted until the following day.

On the fourth day of the disease the patient was placed on the sick list. An inspection for concealed diseases, and an investigation of circumstances connected with these diseases were immediately made by the group medical officer and a genito-urinary specialist. Culture was made on chocolate agar which grew well and in 48 hours the gonococci were recovered.

Treatment instituted consisted of absolute isolation of the patient, instillation of 1-percent atropine sulfate and 25-percent argyrol 3 times daily, and irrigations every 10 minutes, day and night, with a saturated solution (0.2 percent) of sulfanilamide. Sulfathiazole, 60 grains, was given immediately and 15 grains continued every 4 hours. Cold compresses were applied to the left eye for 30 minutes of every hour.

On the fifth day of the disease 25 million organisms of typhoid vaccine were given intravenously with no resultant chill or fever. The following day 40 million organisms of a different strain of typhoid vaccine were given and a marked chill and temperature of 105° F. resulted. The cornea was hazy with thick pus present and marked chemosis of the conjunctiva was noted. On the seventh day of the disease the cornea was quite hazy and a large mass of pus was attached to its lower one-third. The anterior chamber was quite shallow, showing that a perforation of the cornea had occurred. The ninth day of the infection the cornea was cloudy, conjunctiva beefy-red, and the secretion had diminished slightly. The anterior chamber was shallow.

On admission to a base hospital this patient was given penicillin and the secretion became much less in 24 hours. The cornea was entirely destroyed and after a few days of penicillin therapy the eye was eviscerated.

Case 2.—A signalman, age 20, had symptoms similar to the first patient except that they were not so severe. He also received similar treatment. On the seventh day of the disease a descemetocoele formed in the lower part of the cornea. Penicillin was administered after admission to a base hospital and the secretion diminished.

COMMENT

Two cases of gonorrheal ophthalmia have been reported which were presumably contracted by the use of binoculars. One of these patients lost his eye, even with liberal doses of sulfathiazole and other accepted treatment.

In view of these two cases it is felt that binoculars should not be used promiscuously by all personnel. If it is necessary that several persons use a single pair of binoculars the eye pieces should be sterilized with an accepted antiseptic which will not harm them. Exposure to sunlight, if conditions permit, should also be practiced.

From the improvement shown in lessening the secretion in both of these patients after 48 hours of penicillin therapy, this drug should offer some hope, especially if given early in the course of the disease.



NONSPECIFIC ULCERATIVE COLITIS

Nonspecific ulcerative colitis is an inflammation of the large bowel, including the rectum, without known etiology, occurring in cycles and usually accompanied by diarrhea with sanguineous and/or mucopurulent discharge. The lower portion of the bowel is most frequently involved, but the process may be generalized. The amount of discharge depends on the severity and degree of involvement. Diagnosis is made by sigmoidoscopy. The absence of haustrations as seen by x-ray is significant. Characteristic miliary ulcers are seen which break down and form abscesses. There is often muscular hypertrophy, the rectal muscles and tenia being most commonly affected. The lumen of the bowel may become enlarged or narrowed. In the latter instance, spasm may be responsible or cicatrization may have led to organization and permanent blocking, necessitating operation.—DANIELS, G. E.: Nonspecific ulcerative colitis as psychosomatic disease; definition, clinical and pathological picture. *M. Clin. North America* 28: 593-602, May 1944.



AMINO ACID AND PLASMA PROTEIN PRODUCTION

When blood plasma proteins are depleted by bleeding with return of red cells suspended in saline (plasmapheresis) it is possible to bring dogs to a steady state of hypoproteinemia and a constant level of plasma protein production if the diet nitrogen intake is controlled and limited. Such dogs are outwardly normal but have a lowered resistance to infection and to certain intoxications.

The ten growth-essential amino acids of Rose plus glycine will maintain nitrogen balance and produce as much new plasma protein as will good diet proteins. This good utilization is demonstrated over periods of several months when the amino acids are given either orally or parenterally. There is no evidence of toxicity in general nor to unnatural forms of these synthetic amino acids in particular.—MADDEN, S. C.; WOODS, R. R.; SHULL, F. W.; and WHIPPLE, G. H.: Amino acid mixtures effective parenterally for long continued plasma protein production. Casein digests compared. *J. Exper. Med.* 79: 607-624, June 1, 1944.

EARLY OPHTHALMIC FINDINGS IN A CASE OF SPONTANEOUS SUBARACHNOID HEMORRHAGE OF BRAIN

KARL B. BENKWITH
Lieutenant (MC) U.S.N.R.

Spontaneous subarachnoid hemorrhage is a fairly common intracranial condition in individuals in the second and third decades of life. Probably the most readily available clinical findings and signs associated with this disease are those demonstrable with the ophthalmoscope. The observations are those that need no special training for their recognition.

We are concerned here with the acute episode of sudden onset, collapse and coma with no known premonitory signs and symptoms, or history of previous attacks. The medical diagnosis depends on clinical and laboratory observations. A spinal puncture should be preceded by simple observation of the eyes even before transfer of the patient to a hospital. The very early clinical eye findings are probably not papilledema or palsies of the third, sixth and other cranial nerves, but retinal hemorrhages which tend to localize in the eye on the side most involved in the anatomic location and extension of the subarachnoid hemorrhages.

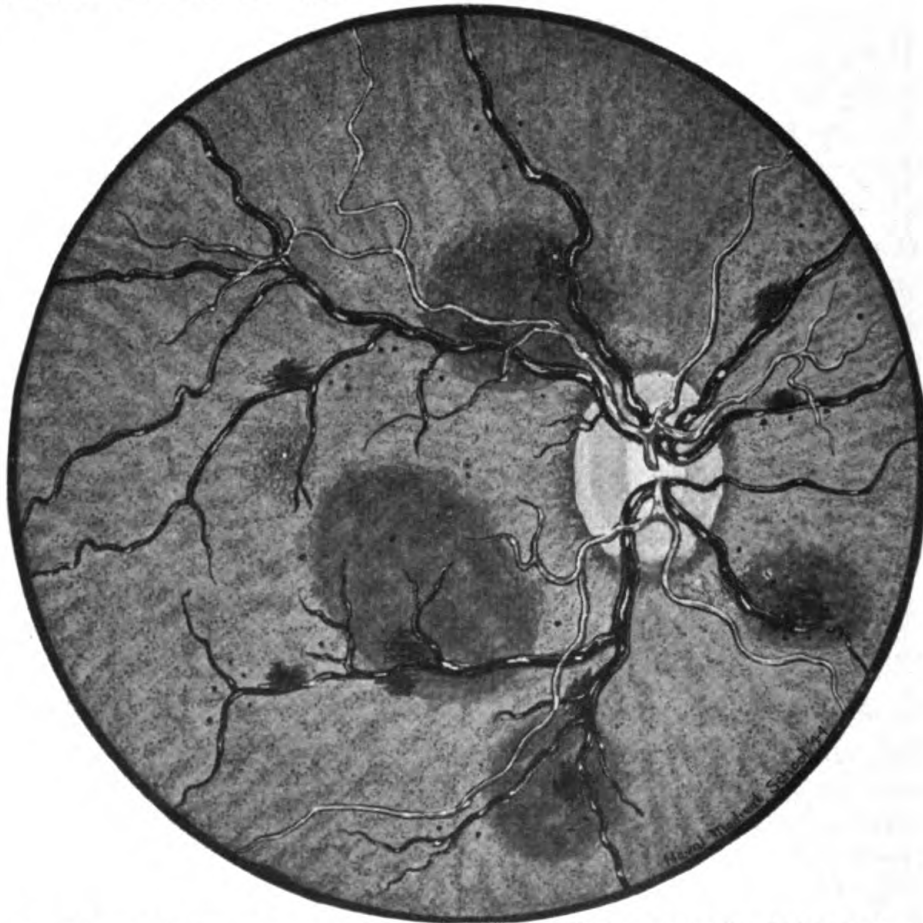
Following the onset of retinal hemorrhages, which progress to a definite picture, palsies of the third, fourth, sixth and other cranial nerves may occur before such generalized clinical findings of a positive Kernig, positive Babinski, and other signs. Without the eye findings the clinical findings may be confused with those of other diseases.

Case report.—A 33-year-old enlisted man reported to the chief mate in charge of commando training at an advance base personnel depot that he had a headache, felt dizzy, and had a sudden ringing in his ears. Suddenly, while addressing the chief mate, he fell to the ground unconscious. This accident occurred at 1000 on the commando course. At 1010 the man was brought to the dispensary on a litter, wrapped in blankets, collar open, airway free; his breathing was stertorous, color pale and skin clammy.

Examination disclosed that there was no positive Kernig or Babinski sign and the patient was in coma. The blood pressure had dropped to 70/20 and remained there. Both pupils were constricted, reacted questionably to light and the fundi were negative. At 1020 it was noted that the right pupil began to dilate to mid-dilation and remained that way. Neither pupil at this time was active to light stimuli, directly or consensually; the corneal epithelium was beginning to become irregular from the drying effect of exposure. The lids remained open, except when forceably closed, and no proptosis was present.

The fundus of the right eye showed a normal appearing disc with a moderate size physiologic cup; no papilledema was present. The retinal arterioles showed generalized attenuation with very definite foci of spasm in the proximal portions of the arterioles. The retinal veins were greatly distended showing no areas of constriction by crossing retinal arterioles; they seemed to go on their way without impediment. The arterioles and veins showed no greater than normal tortuosity.

Numerous round hemorrhages, pin-point to pin-head in size, and many flame-shape ones were gradually making their appearance in close approximation to the retinal veins. These were associated with the proximal half of the retinal veins, but always one-half to one disc diameter away from the optic disc. Their number increased with time, and some coalesced to form large patches of hemorrhage.



Fundus of right eye showing attenuated arterioles, greatly distended veins, round pin-point and flame-shape hemorrhages, and large nummular intraretinal hemorrhages.

Finally, in addition to the above mentioned hemorrhages, there gradually appeared large nummular, brick-red hemorrhages the size of the disc, at first isolated over and around the various retinal veins at approximately one and two disc diameters from the margin of the optic disc. These began as faint patches but as they gained volume became heavy, dark bloody areas, one extending into the macula. There were only insignificant hemorrhages at the optic disc margin.

The picture was not unlike early central retinal venous thrombosis; however, the hemorrhages were lacking in continuity with the disc. Toward the end of a 30-minute period of observation of the fundus of the right eye, it was seen that the fundus of the left eye showed arteriole spasm and venous congestion but no hemorrhages or papilledema.

With these findings the diagnosis was made of vascular accident localized on the right side of the cerebrum. The spinal fluid was grossly bloody and under pressure. The patient was transferred to the hospital and died at 1300, a few minutes after the lumbar puncture. Autopsy findings showed a massive subarachnoid hemorrhage originating from the right anterior cerebral artery at the circle of Willis, with extensive extravasation of blood predominantly over the right basal cerebrum and out into the right optic sheath.

It is of interest that shortly after completion of the lumbar puncture the right pupil constricted to approximate again the size of the left pupil. The fundi, just previous to death, showed massive intraretinal hemorrhage with fullness of the disc in the right eye. There was no hemorrhage or papilledema in the left eye.

From this observation, it appears that the hemorrhage in the right fundus did not come directly from the hemorrhage in the optic nerve sheath, but instead, from the engorged, obstructed, and injured veins of the retina. There was no evidence that the hemorrhage had broken through the internal limiting membrane of the retina and entered the vitreous.



EMOTIONS AND THE HEART

The heart is an organ which is highly sensitive to emotional excitement to the extent that very few individuals ever claim an immunity from this susceptibility, and a long-continued period of even mild anxiety renders the organ irritable and liable to become excited under a relatively slight excess of emotional feeling. The pulses of such a person may become accelerated by the simple act of taking it. Active fear and rage produce palpitation. Rage may also produce precordial oppression and is known to have brought on attacks of syncope or even of angina pectoris. Excessive grief may initiate a functional disorder with altered action of the valves, the patient becoming pale and anemic. Many of the keen observing physicians of other days noticed that anxiety, disappointment and grief altered the heart functions and that contentment or peace of mind favored its healthy action.—LEWIS, N. D. C.: Psychosomatic factors in disorders of circulatory system. *M. Clin. North America* 28: 565-576, May 1944.

AIR EMBOLISM IN A DIVER

REPORT OF FATAL CASE

FRANK J. GOUZE

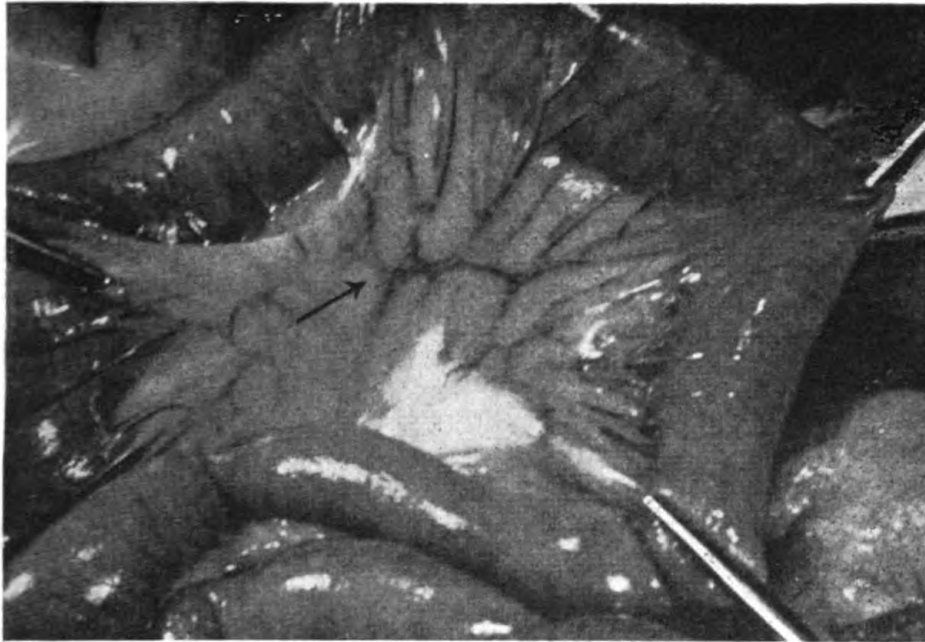
Lieutenant Commander (MC) U.S.N.R.

Air embolism occurring as a diving accident is the result of the diver holding his breath during ascent. As the pressure outside the chest decreases in ascending, there is a resultant increase in the intrapulmonic pressure in the lungs due to the expansion of the entrapped air. This increased pressure produces a marked drop in pulmonary circulation by compression of the pulmonary vessels, a consequent drop in blood pressure, and ultimately, lung rupture. The re-establishment of pulmonary circulation occurs when the diver surfaces and exhales, thereby relieving the excess pressure. At this moment, air enters the ruptured pulmonary vessels resulting in aero-embolism.

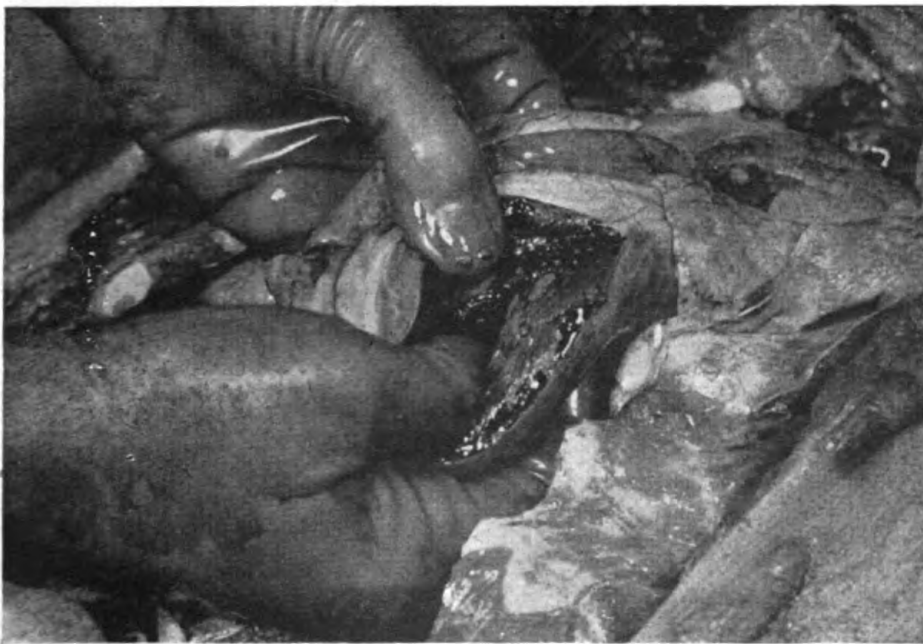
The case to be reported here, however, represents an unusual sequence of events in the production of embolism. In this case the restoration of pulmonary circulation and consequent release of air into the circulation through the ruptured lungs was brought about by the decrease in the excess intrapulmonic pressure when the diver fell to the bottom. Attention is called to the fact that much shallow-water diving is being done by men whose training has been brief; consequently medical officers should be on the alert for such accidents.

ported here, however, represents an unusual sequence of events in the production of aero-embolism. In this case the restoration of pulmonary circulation and consequent release of air into the circulation through the ruptured lungs was brought about by the decrease in the excess intrapulmonic pressure when the diver fell to the bottom. Attention is called to the fact that much shallow-water diving is being done by men whose training has been brief; consequently medical officers should be on the alert for such accidents.

Case report.—A seaman, first class, 19 years old, was making a training dive at 40 feet with a standard face mask which was supplied with compressed air from flasks in the diving boat. This was his second dive of this type. He was down for 19 minutes when he was given the signal to come up. He answered the signal, started up, and gave no indication that anything was wrong until he had ascended about 15 feet; at this point he began to struggle and pull on his life line and airhose as if he were climbing it. The tender thought he was signaling for slack in his hose in order to clear it, so he gave him slack. At about that time the struggling and pulling ceased, and the diver did not answer a signal asking if he was all right. Another diver who



1. Arrow indicates air bubbles in mesenteric vessels.



2. Frothy blood in left ventricle.

was just coming up from a dive was sent down to investigate, and found the first diver lying on his back in the mud, his right leg caught in a loop of life line about 4 feet from the bottom. The diver was motionless, and the face mask was around his neck.

He was immediately brought to the surface. Air was coming from his mask and his weighted belt was still in place. A frothy but clear foam drooled from his mouth. The attendants believed he had drowned, so began immediate

artificial respiration. Approximately 5 minutes elapsed from the time the diver had indicated he was in trouble to the time he was brought to the surface by the second diver. Examination by a doctor about 5 minutes later revealed no breathing, no pulse, and on auscultation no heartbeat. Resuscitation measures of artificial respiration, stimulants, and oxygen failed to revive him. Recompression was not used because the complete story of the diver's having ascended part way was not given to the attending medical officer. No signs of life were detected.

Autopsy.—Autopsy established the cause of death as air embolism. Acute emphysema of the lungs was found, with multiple air emboli of the heart and of the arteries and veins of the entire body. There were small infarcts of recent origin of the lungs, spleen, kidneys, and intestines.

On opening the abdomen 4 infarcts of the intestines were seen and all the mesenteric vessels contained numerous air bubbles (fig. 1). The spleen showed passive congestion and numerous recent infarcts.

The chest showed no pneumothorax, but many minute air spaces were seen throughout both lungs, suggesting abnormal distention of the alveoli. No large blebs were seen. The lungs were crepitant, and when sectioned showed many small flame-shape areas of hemorrhagic infiltration.

When the brain was removed bubbles issued from both carotids. There was a distinct but indefinitely demarcated discoloration of the brain in the left posterior parietal and right temporal regions. Very few air bubbles were seen in the surface vessels of the brain. Serial section revealed no macroscopic changes.

Incision of the femoral, abdominal and subclavian vessels revealed air bubbles. Air could be expressed from the vessels of the legs and arms. It seemed that there was definitely more air in the lower extremities than in the upper.

COMMENT

The accident was reconstructed as follows: When the diver started to ascend his face mask was pulled off, probably by entanglement with his lines. Holding his breath, he ascended 15 feet; then rupture of the lungs occurred, which caused him to struggle and to try to come to the surface. As he was ascending the intrapulmonic pressure increased enough to rupture the lungs and compress the pulmonary vessels. Because of this the amount of blood expelled by the left ventricle was not sufficient to maintain the systemic blood pressure. At this point the diver probably lost consciousness.

This phenomenon was clearly shown by Polak and Adams (1) in their experiments on the production of air embolism in dogs. On increasing the intrapulmonic pressure to 100 mm. Hg. and maintaining it for 10 seconds, they observed a sharp drop in the systemic blood pressure and rupture of the lungs, but no emboli appeared in the circulation. Air appeared shortly after release of the intrapulmonic pressure. In the case reported here the release of pressure undoubtedly occurred when the diver sank to the bottom, for then the original air volume and pressure in the lungs

were restored, permitting air to enter the pulmonary veins. The autopsy reports by Polak and Adams revealed emphysema of the lungs, rupture of the alveoli, and hemorrhages throughout the lungs. Air emboli were found in the surface vessels of the brain and in the coronary and mesenteric vessels. The same findings were noted in the diving and lung-escape cases reported by Behnke (2). It is noteworthy that the pathologic findings in Behnke's cases, Polak and Adams' dogs, and the diver whose case is reported are identical.

Analysis of the physiology of this accident shows the following: The bottom pressure was approximately 33 pounds absolute. When the diver ascended 15 feet the external pressure was about 26 pounds absolute. The difference in pressure was then 7 pounds or 362 mm. Hg. This created an increased intrapulmonic pressure which was sufficient to cause tearing of the lungs. Polak and Adams showed that not only increased pressure, but distention of the lung was necessary to cause rupture; no rupture occurred when the chest of the dog was bandaged to prevent distention, even though an intrapulmonic pressure of a previous rupture level was used.

It seems, therefore, that before rupture can take place, the increased volume of air distends the lungs to the vital capacity level, and then further increase of intrapulmonic pressure causes lung rupture. Polak and Adams did not show what pressure was necessary to rupture the lungs if overdistention was prevented by bandaging the chest and abdomen. It appears reasonable that the pressure necessary to produce rupture of the lung is directly related to the vital capacity and the actual volume of air in the lungs at the beginning of the increase in pressure. Therefore a smaller volume of lung air would need a greater change of intrathoracic pressure to cause rupture.

Theoretically, if the lungs had a full vital capacity breath, only a 5-foot ascent, holding this breath, would be necessary to raise the intrapulmonic pressure to 112 mm. Hg; this pressure was enough to rupture the dogs' lungs when they were fully distended. Apparently the complemental air capacity is a reservoir that prevents rupture of the lungs; this complemental capacity must be satisfied before complete distention occurs. Shilling (3) has shown expiratory values as high as 350 mm. Hg. with no air embolism. This tends also to bear out the fact that not only increased intrapulmonic pressure, but complete distention is necessary for rupture of the lung.

In diving, when the victim of a lung accident reaches the surface he reduces the high intrapulmonic pressure by exhaling. This re-

duction of pressure permits the blood to flow through the pulmonary vessels. Consequently air can enter the ruptured vessels and be carried to other parts of the body. In the case discussed here, when the diver's lungs ruptured he probably released his hold on the lines and fell to the bottom. This compressed the air in the lungs to its original volume, and as a result blood flowed again through the pulmonic vessels and air entered the pulmonary veins. Even though the diver was unable to breathe, the heart continued to beat and spread the air through the body. Polak and Adams found that the dog's heart beat 2 minutes after breathing stopped.

Van Allen (4) advanced the theory that the buoyancy of air determines its distribution in the various parts of the body. At autopsy of this diver very few bubbles were observed in the vessels of the brain and many bubbles in the lower extremities. This could be explained by the fact that the diver was found in a head-down position, one leg being entangled in the life line about 4 feet from the bottom. As mentioned before, the heart would beat and circulate air bubbles even though breathing had stopped. The buoyancy of the bubbles would then tend to make them rise and enter the lower extremities. This shows that carrying such casualties in the head-down position is advisable since it would lessen the distribution of air to the brain.

REFERENCES

1. POLAK, B., and ADAMS, H.: Traumatic air embolism in submarine escape training. U. S. Nav. M. Bull. 30: 165-177, April 1932.
2. BEHNKE, A. R.: Analysis of accidents occurring in training with submarine "lung." U. S. Nav. M. Bull. 30: 177-185, April 1932.
3. SHILLING, C. W.: Expiratory force as related to submarine escape training. U. S. Nav. M. Bull. 31: 1-7, January 1933.
4. VAN ALLEN, C. M.; HRDINA, L. S.; and CLARK, J.: Air embolism from pulmonary vein; clinical and experimental study. Arch. Surg. 19: 567-599, October 1929.



SUCCINYL SULFATHIAZOLE AND ONE-STAGE OPERATIONS

The use of succinyl sulfathiazole in large bowel surgery permitted two desirable improvements in management of the surgical patient. First, the effective reduction of susceptible organisms in the stool in the presence of a high protein diet made permissible the employment of a balanced and palatable preoperative nutritional management. This is probably inferential. However, the second advance that the drug has made is the disappearance of stage-operations. Primary anastomosis under permissible anatomic conditions at any level of the large bowel has resulted in no disaster.—ARCHER, H. L., and LEHMAN, E. P.: Clinical and laboratory experiences with succinyl sulfathiazole. Ann. Surg. 119: 518-524, April 1944.

PARAFRENAL ABSCESS

COMPLICATION OF GONORRHEAL URETHRITIS

BEN KLOTZ

Lieutenant Commander (MC) U.S.N.R.

Whenever a case of gonorrheal urethritis does not make a favorable, progressive response to treatment one begins to look for evidence of extension of the infection. Examination may reveal a small external meatus and a narrowed fossa navicularis, the involved glands of Littre may be felt as small nodules, and a stricture of the urethra may be demonstrable. Cowper's glands, the prostate, the seminal vesicles and epididymides singly or together, may be involved in the infectious process.

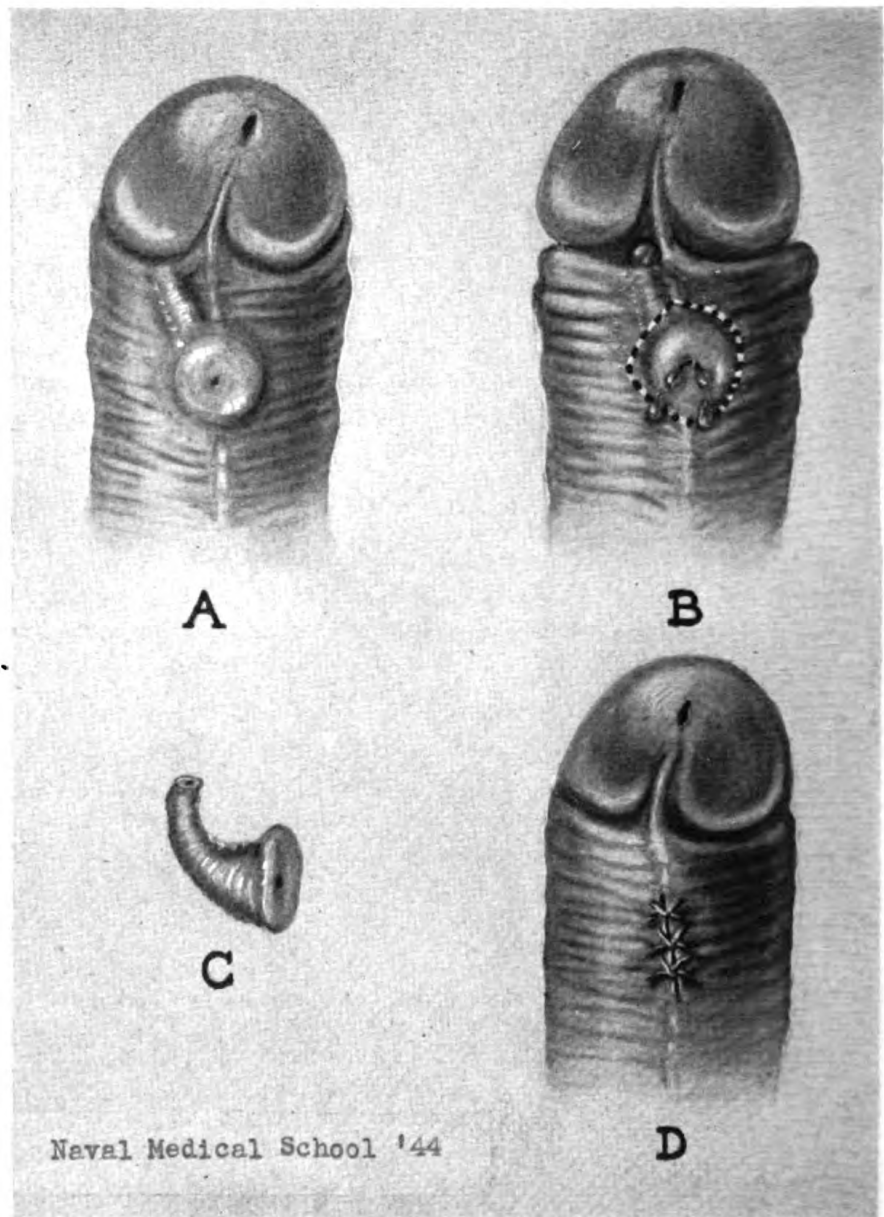
Infection of the parafrenal gland of Tyson is an infrequent complication of gonorrheal urethritis. This brief report deals with such a case.

The mention of these glands is not found in the textbooks on anatomy in common use. Pelouze¹ in his monograph on gonorrhea, gives a detailed description of the parafrenal glands and discusses their treatment when involved in the gonorrheal infection. The glands are located in the prepuce on either side of the midline near the base of the frenum. Their ducts lead to a tiny opening on either side of the base of the frenum.

Case report.—A private in the Marine Corps Reserve was admitted to the hospital because of a urethral discharge which had been present for 10 days. He had been treated in the dispensary without effect for 1 week with one of the sulfonamides. The present infection followed a recent unprotected exposure. He stated that he had had gonorrhea one year ago and during that infection had developed a swelling on the prepuce. This swelling had persisted ever since and from time to time he could obtain pus at the base of the frenum by squeezing this swelling.

Examination revealed a moderate urethral discharge which showed the presence of gram-negative intracellular diplococci. With the prepuce still covering the glans, a small nodule could be seen at the very edge of the prepuce on the ventral surface. When the prepuce was fully retracted this pea-size, slightly firm, nontender swelling was seen about 2 cm. from the base of the frenum. Strangely, it was to the left of the midline. A hard fibrous cord about 2 mm. in diameter and about 2 cm. in length led to a pin-point opening at the base of the frenum on the right side. Pus could be expressed from this opening and from a pin-point opening in the abscess itself. Pus from both openings revealed the presence of gram-negative intracellular diplococci. The urethritis made a prompt response to local application of

¹ PELOUZE, P. S.: *Gonorrhea in the Male and Female*. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1939. pp 295-296.



- (A) The paraphrenal abscess in the partly retracted prepuce. (B) The paraphrenal abscess in the completely retracted prepuce; its duct, in outline, leading to the orifice at the base of the frenum. (C) The excised specimen showing the duct and the abscessed gland with the excised skin attached. (D) Closure of incision.

strong silver protein used twice daily for 3 weeks. The penis was soaked frequently in warm water.

After treatment had been stopped for 1 week, during which time there was no discharge, the parafrrenal gland was excised under local anesthesia. An elliptical incision was made around the gland so as to remove its attached skin with it. The fibrous duct was isolated and removed, without tying, up to but not including its orifice by tunneling beneath the preputial skin. The skin was closed with catgut. The wound healed by first intention and the resultant swelling resolved in several weeks.

Several days after the excision, the urethral discharge recurred. The infection responded to the same local therapy, but fever developed after the administration of 6 gm. of sulfathiazole. This promptly subsided when the drug was discontinued. The patient was given penicillin intramuscularly every 3 hours in 5 doses of 20,000 units each. The last examination was made after he had been returned to duty for 2 weeks and there had been no recurrence of the discharge at that time.



DIETS AND RHEUMATIC SUBJECTS

In a recent study the diets of 50 rheumatic children from families of low income were analyzed and compared with those of 50 non-rheumatic children from families on high income. Striking differences were found. The diets of the rheumatic children contained less than required amounts of various food components, with most marked inadequacies of protein, iron, and vitamin A. The occurrence of inadequate intake of vitamin A was much more frequent in the rheumatic than in the non-rheumatic children. There was a statistically significant association between susceptibility to rheumatic fever and inadequate intake of vitamin A. In the half of the rheumatic group considered most susceptible to rheumatic fever, only one child received vitamin A in required amounts. An analysis of the diet in terms of units of vitamin A obtained from animal and plant sources revealed that: (a) Children most susceptible to rheumatic fever received an average of 2,280 international units from animal and 2,340 I.U. from vegetable sources, daily; (b) corresponding values for children less susceptible to rheumatic fever were 4,840 I.U. and 4,900 I.U., respectively; (c) non-rheumatic children from families of high income groups received 10,580 I.U. from animal and 4,960 I.U. from plant sources. It was not demonstrated, however, that a deficiency in this single component of the diet bore a causal relationship to rheumatic attacks.—SHANK, R. E.; COBURN, A. F.; MOORE, L. V.; and HOAGLAND, C. L.: Level of vitamin A and carotene in plasma of rheumatic subjects. *J. Clin. Investigation* 23: 289-295, May 1944.

SEVERE IRIDOCYCLITIS TREATED WITH PENICILLIN

CLYDE E. HARNER
Commander (MC) U.S.N.R.

and

JOSEPH G. SMITH
Lieutenant (MC) U.S.N.R.

In the following case of severe iridocyclitis, penicillin was used with complete recovery after atropinization, continuous hot compresses, topical application of sulfanilamide powder to the conjunctival sac, and intravenous typhoid therapy had been used without improvement in the condition. In fact there had been a steady and alarming progress of the ophthalmitis which threatened loss of the eye until penicillin therapy was instituted. The response was immediate; the patient stated that he felt better and claimed that he could see better within a few hours after the first 20,000-unit intramuscular injection of the drug.

Case report.—The patient, a 44-year-old white male civilian, employed as a pipefitter in the Navy yard, was admitted to the Naval hospital complaining of a very inflamed, painful left eye. The right eye had been removed 6 years previously following a dynamite blast injury.

Seven days prior to entry into the hospital, while at work, the patient felt something strike the left eye. At that time he was seen by a private physician but he stated that no treatment was administered. For the next 5 days the patient still had the sensation of a foreign body in the eye so he presented himself at the yard dispensary at which time a foreign body was removed from the cornea. As no subjective relief was obtained he was referred to this hospital.

The patient's past medical and family histories were irrelevant. The results of general physical examination were unimportant. Upon removal of the prosthesis in the right orbit, a bulging was noted under the conjunctiva lining the socket which apparently was scleral tissue. An evisceration operation had evidently been done previously, but there was no inflammatory reaction now present.

Examination of the left eye showed the vision to be 20/30. There was a slight edema of the lids and a mild chemosis and marked hyperemia of the conjunctiva. Ciliary injection was pronounced. There was a small whorl of blood vessels leading to an old corneal scar 4 millimeters from the limbus at the 2-o'clock position. With the slit lamp it was seen that there were numerous faint corneal scars and several minute foreign bodies in the substantia propria of the cornea. In the anterior chamber there were multiple strands of fibrinous exudate, cells, and a marked aqueous flare.

A plastic exudate extended from the pupillary margins to cover the anterior lens capsule. There were posterior synechiae at the 3- and 9-o'clock positions with a constriction of the pupil. Marked engorgement of the iris

vessels was apparent and the iris trabeculae were clogged with inflammatory material. The debris in the anterior chamber was motionless. Keratic precipitates were few and dustlike. The peripheral fundus could not be visualized as the pupil was quite small, but the optic disc and the macular area appeared to be normal. The tonometer tension (Schiötz) was 12. The cornea did not stain with fluorescein despite the history of the removal of the foreign body. X-rays of the orbit did not disclose any foreign bodies.

The upper jaw was edentulous. There was a marked gingivitis and parodontosis around the gums of the remaining lower teeth. X-ray examination of the teeth and jaws revealed a small root fragment in the right maxillary sinus.

Five days after admission, just before starting penicillin therapy, the hemoglobin determination was 12.5 gm. (81 percent), the erythrocyte count 4,150,000, and the leukocyte count 12,450, with 10 percent band forms, 60 percent segmented cells, 70 percent total neutrophils, 5 percent eosinophils, 14 percent lymphocytes and 11 percent monocytes.

On the first day of hospitalization, 3 hours after instilling 1 drop of 4-percent atropine sulfate, the synechiae were broken and a hyphemia resulted which measured 4 mm. above the limbus at the 6-o'clock position. During the same day the patient received 0.1 cc. of triple typhoid vaccine which was diluted with physiologic saline solution to 1 cc. and given intravenously. The vaccine used was that prepared by the Army Medical School and contained one thousand million typhoid, five hundred million paratyphoid A, and five hundred million paratyphoid B organisms per cubic centimeter.

The following day the hyphemia had disappeared. The daily therapy consisted in atropinization, application of hot compresses, and sulfanilamide powder dusted into the eye after the instillation of pontocaine hydrochloride. This was done twice daily. The same dosage of typhoid vaccine was given at the usual 3-day interval and the highest temperature reached after the first injection of typhoid was 102.2° F., and 102° F. after the second injection.

The ciliary and conjunctival injection was very severe and did not improve under the therapy. The anterior chamber was very cloudy. It was loaded with cells, fibrin and pigment. The vessels of the iris were congested. The pupil did not dilate well. The tonometer tension was 12. It was therefore decided to resort to penicillin. Twenty thousand units of the drug were given intramuscularly every 3 hours for 5 doses. There was very little appreciable change on this treatment for 2 days. On the third day, however, the ciliary injection was definitely lessened. The pupil was well dilated. There was no chemosis. There were no fibrin strands in the anterior chamber. There were cells and an aqueous flare, but the cells were moving quite actively. Penicillin was discontinued but the atropine and hot compresses were continued. The eye continued to improve and there were no signs of iritis. The vision was 20/25 and the patient was discharged as cured 2 weeks after admission. During his hospital stay his periodontoclasia had been treated by the dentist with excellent results.

SUMMARY AND CONCLUSIONS

In analyzing the various factors in this case the following possibilities had to be considered: (1) Endogenous infection with the dental condition the most likely focus; (2) sympathetic ophthalmia; and (3) intra-ocular involvement from an attempt to remove a recent or old intracorneal foreign body.

The presence of sclera and probable uveal tissue in the right orbit gave considerable concern as to whether a sympathetic ophthalmia was the causative factor. The lack of staining with fluorescein precluded the probability of intra-ocular extension from trauma to the cornea.

This was a most fulminating endogenous infection and it is believed that but for penicillin therapy the condition would have gone on to permanent damage if not total destruction of the eye, and in this case, total blindness. The other therapeutic agents employed such as typhoid vaccine, atropine, sulfanilamide, and hot compresses, as well as the dental therapy, cannot be completely discounted, although no improvement was apparent until penicillin was administered.



An officer patient sustained a compound fracture of the left tibia and fibula as the result of a fall from a second-story window. He was admitted to this hospital about two hours later. Examination revealed a 4-inch laceration, 4 inches above the external malleolus. The x-ray examination disclosed spiral, comminuted fractures of the tibia and fibula.

The wound was thoroughly irrigated and debrided. Sulfanilamide powder was implanted and the skin was loosely closed. The extremity was immobilized in plaster, using pins above and below the site of fracture. The patient was given a tetanus booster and sulfadiazine orally in the customary doses. He had received the standard tetanus immunization about eleven months prior to the present accident.

During the following 4 days the temperature fluctuated but did not rise above 101.6° F. On the morning of the fifth post-operative day the patient developed a trismus and stiffness of the neck. A window was cut in the plaster and the wound was opened and packed with potassium permanganate crystals. Seventy thousand units of tetanus antitoxin were administered by vein and 10,000 units subcutaneously in the left thigh. In the next 7 days from 2,000 to 3,000 cc. of intravenous fluids were given daily. A total of 200,000 units of antitoxin were administered during the period of treatment in the following doses. On the first day 70,000 units were given intravenously and 10,000 units subcutaneously, on the third day 50,000 units intravenously, on the fourth day 20,000 units intravenously, and on the fifth day 50,000 units intravenously. The patient died 12 days after admission.

Necropsy revealed marked necrosis of the soft tissues about the site of the injury. Tetanus organisms were recovered from the wound and demonstrated microscopically.—LECOQ, E. A., Commander (MC) U.S.N.R.

WATERHOUSE-FRIDERICHSEN SYNDROME

REPORT OF A CASE

MILTON B. FILBERBAUM

Lieutenant Commander (MC) U.S.N.R.

The syndrome of meningococcemia with acute adrenal hemorrhage (Waterhouse-Friderichsen syndrome) is being reported with increasing frequency in the recent literature. Despite some dispute as to its characteristics as a clinical entity, the dramatic progress of such cases as the one here reported seems to follow a very definite pattern.

Case report.—A 20-year-old Marine private was admitted to the hospital complaining of pain in the legs, chills, nausea, and vomiting.

Seven days prior to admission he had returned from a furlough in apparently good health. Four days later he experienced pain in the ankles and legs which increased in severity, and on the following day he developed chills, nausea and vomiting. His condition became rapidly worse so that at the time of admission he was unable to speak coherently and had developed fecal incontinence. On the day prior to admission he first noted "spots" on the arms and legs.

Examination on admission revealed him to be somewhat disoriented with only a hazy memory of events of the preceding days. The entire body and the conjunctivae were covered with numerous petechial hemorrhages varying from pin-point size to about 1.5 cm. in diameter. There was slight nuchal rigidity and stiffness of the skeletal muscles on motion. Motion of the lower extremities evoked expressions of pain. The pulse was barely perceptible. The blood pressure was 60/30, pulse rate 140, respirations 32, and temperature 103° F. There was some impairment of resonance over the lower right portion of the chest. The heart sounds were rapid and distant. The abdomen was somewhat tense. The liver was felt one finger's breadth below the costal margin. The spleen was not palpable. The lower extremities were intensely cyanotic. There was marked hyperesthesia around the ankles and over the anterior surfaces of the legs. Knee jerks were absent. Kernig's sign was positive. Results of neurologic examination were otherwise negative.

The hemoglobin content of the blood was 13 gm.; erythrocytes numbered 4,300,000 per cubic millimeter, and leukocytes 21,750 with a differential count of 30 lymphocytes, 4 monocytes, 6 band forms and 60 segmented cells. On lumbar puncture the spinal fluid was found to be clear and under normal pressure. The cell count was 18 and total protein content 30. No organisms were found in the smear. Culture of the blood and spinal fluid was done but was not reported until after the patient expired.

The patient was given large doses of sulfadiazine and large amounts of fluid intravenously. Although meningeal signs and spinal fluid changes were minimal, his course was rapidly downhill. Seven hours after admission the radial pulse became imperceptible. Heart tones were very distant and too rapid to count. Respirations were 60 to 70. The patient became restless, semiconscious, markedly cyanotic and shortly thereafter died.

Cultures made of the blood and the spinal fluid showed the presence of *Neisseria intracellularis*.

Postmortem examination was confined to the abdomen. The skin over the entire body was covered with purpuric spots, the largest of which was 15 mm. in diameter. The spleen was moderately enlarged, mushy and of a brick red color. The adrenals were about one and one-half times normal size. They were filled with numerous fresh hemorrhages with destruction of most of the parenchyma and loss of normal architecture. The abdominal contents were not otherwise remarkable. The cause of death was attributed to meningococcic bacteriemia and hemorrhages in the adrenal glands.

Despite the omission of autopsy of the meninges and brain, the presence of the neisserian organisms in the blood and spinal fluid, the rapid circulatory collapse and the pathologic changes in the adrenal glands suggest this as a true Waterhouse-Friderichsen syndrome.



COMMON MISCONCEPTIONS ABOUT PHYSIOLOGY OF HIGH TEMPERATURES

Certain popular notions and scientific claims concerning the physiology of heat have been examined in the light of recent experimental work. The following conclusions have been reached:

1. Best work performance in hot environments is obtained when men are well hydrated. Contrary to current popular conception, thirst should be quenched thoroughly during periods of work.

2. Acclimatization to hot environments appears to be carried out principally by an improvement in the circulation of the blood. The decrease in metabolism and the increase in sweating which occur during several days' exposure to heat appear to be of secondary importance in the process of acclimatization.

3. There is no foundation for the belief that protein intake should be limited in hot climates.

4. Carbohydrate has no special effect on the ability to work in the heat or on heat exhaustion.

5. An adequate NaCl intake (15 to 17 grams a day) appears to be more important to prevent heat exhaustion than to prevent heat cramps.

6. Water soluble vitamins (with the possible exception of niacin) are not lost in significant amounts in the sweat.

7. Ascorbic acid appears to have no effect on the prophylaxis or treatment of heat exhaustion.

8. There is no satisfactory evidence that water soluble vitamin requirements are increased in hot climates but it should be pointed out that it has not been proved that these requirements are not ultimately affected under these conditions.—TAYLOR, H. L.: Some common misconceptions concerning physiology of high temperatures. Bull. Minnesota M. Found. 4: 90-93, May 1944.

SODIUM FLUORIDE POISONING

REPORT OF CASE

OSCAR GREENE

Lieutenant Commander (MC) U.S.N.R.

Poisoning by sodium fluoride is relatively uncommon, but the almost specificity of the chemical as a roach exterminant, and its presence in the commonly used roach powders, makes it a constant menace. When not taken with suicidal intent, its ingestion has generally been in error for starch, for baking powder, or as a laxative. The fatal dose for an adult is between 5 and 10 gm.

Case report.—At about 1900 on 3 March 1944 the patient, a seaman, second class, 35 years of age, dissolved about $1\frac{1}{2}$ teaspoonfuls of sodium fluoride in a cup of coffee and swallowed it. He was 5 days absent over leave at the time and had been under treatment by his family physician for acute gastroenteritis. This information was given over the telephone by his relatives. They were told to give him as much egg white, milk, and syrup of ipecac as possible.

The patient arrived at the dispensary at 2100 at which time physical examination revealed his temperature, respiration, and blood pressure to be normal. His pulse rate was 110. He appeared to be in good general condition but complained of severe headache, epigastric distress, and malaise. Immediately after admission he willingly took the following: One gallon of milk, the whites of six eggs, and 15 cc. of syrup of ipecac. He immediately vomited this over a period of an hour. He was also given 2,000 cc. of a 5-percent solution of dextrose in water and 10 cc. of a 10-percent solution of calcium gluconate intravenously.

The clinical course was uneventful; no further medication was necessary and on 7 March the patient was symptom free.

The patient insisted on repeated questioning that he had taken $1\frac{1}{2}$ teaspoonfuls of sodium fluoride. The obvious conclusion in this case is that since his clinical condition did not vary much from normal he had evidently been able to rid his body of this poison by violent emesis before it had been absorbed into the circulation.

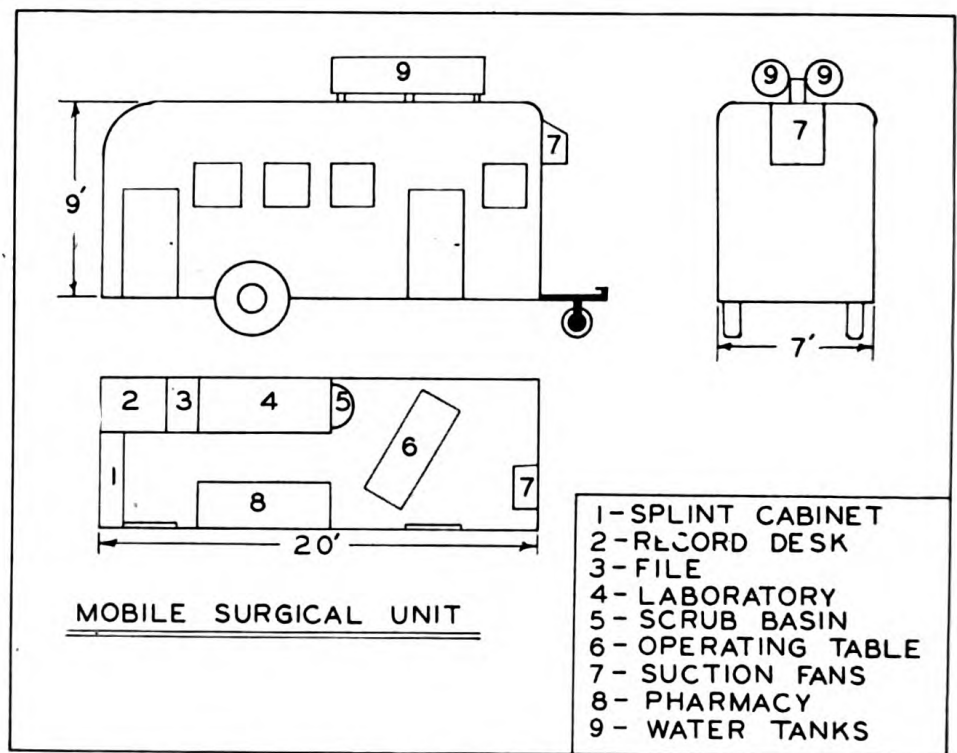
MEDICAL AND SURGICAL DEVICES

MOBILE SURGERY UNIT FOR AMPHIBIOUS OPERATIONS

FRANK S. ASHBURN
Lieutenant (MC) U.S.N.

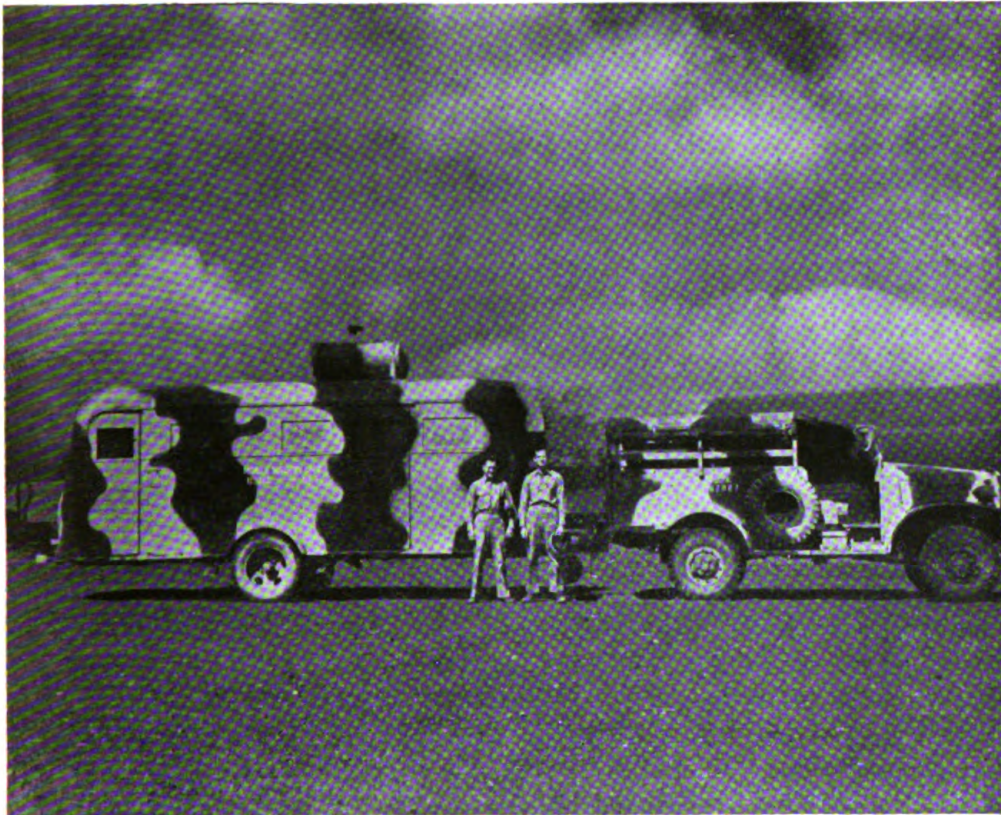
The high casualty rate accompanying some amphibious operations and the character of the wounds demand a readily accessible major surgical setup. The nature of equipment now used in such operations allows the landing of motorized equipment in bulk heretofore impossible. It was this combination of circumstances that led to the construction of the mobile surgical unit to be described.

An obsolete Army Signal Corps trailer was obtained and remodeled as shown in figure 1. Storage space for sterile linens and instruments, drugs, medicines, and splints, as well as space for operating was provided. A folding scrub basin and a pressure cooker-type sterilizer were provided. Screens and automobile-type windows made the operating area flyproof and dustproof. Suction

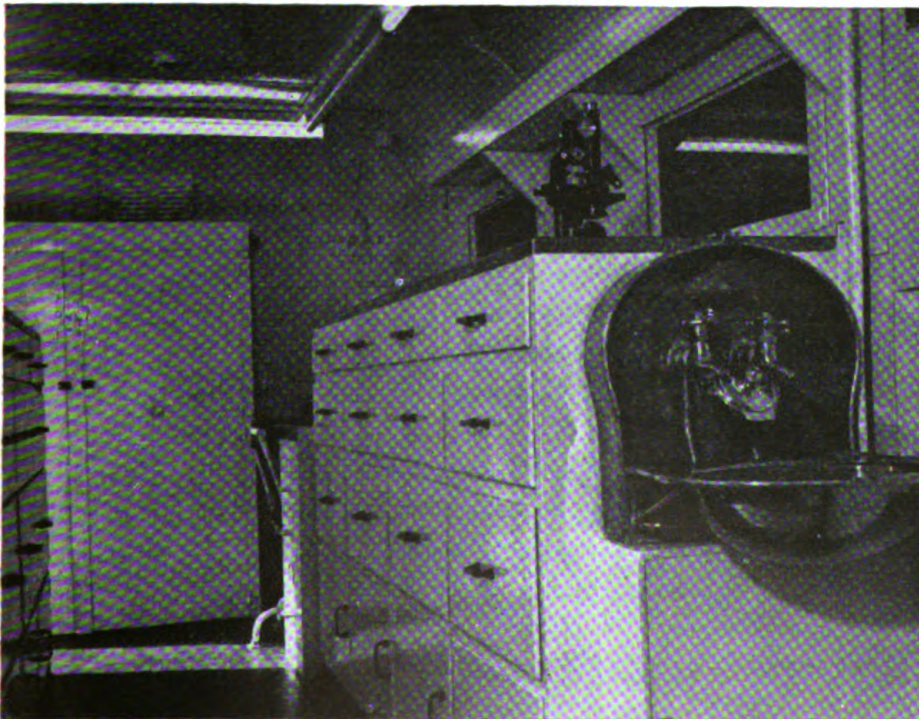


1. Remodeled Army Signal Corps trailer.

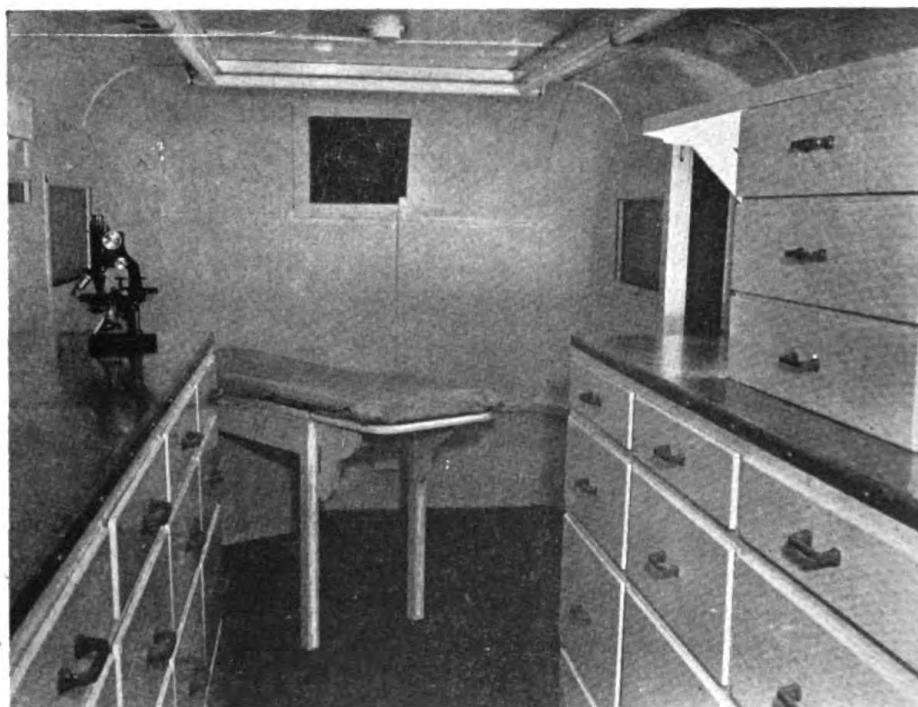
fans were installed in both ends of the trailer to assure adequate ventilation.



2. Showing mobile surgical unit ready for moving.



3. Looking aft from operating area. Note scrub basin and rear ventilation fan grill. The top of cabinet shown provides adequate "accessory instrument table" space.



4. Looking forward. Note suction fan grill. Operating lights are not shown but are now installed. Operating table is in location it occupies while surgery is in progress.

The cabinets were so constructed that when no operation was in progress, full laboratory and pharmacy facilities were available as well as a record office. The operating table was built to serve as the medical officer's desk when no surgery was contemplated. The remaining floor space was utilized completely, at the time of loading for combat, to carry supplies (medical unit chests and miscellaneous equipment) which otherwise would have consumed cargo space already at a premium.

Camouflage nets were carried topside along with hospital tents and sandbags. Landing was made without incident, and when the trailer was placed in a trench 3 feet deep (dug by a bulldozer in 15 minutes) and sandbagged properly it was relatively bombproof. Gas protection equipment was provided and lighting was furnished by a small gasoline motor.

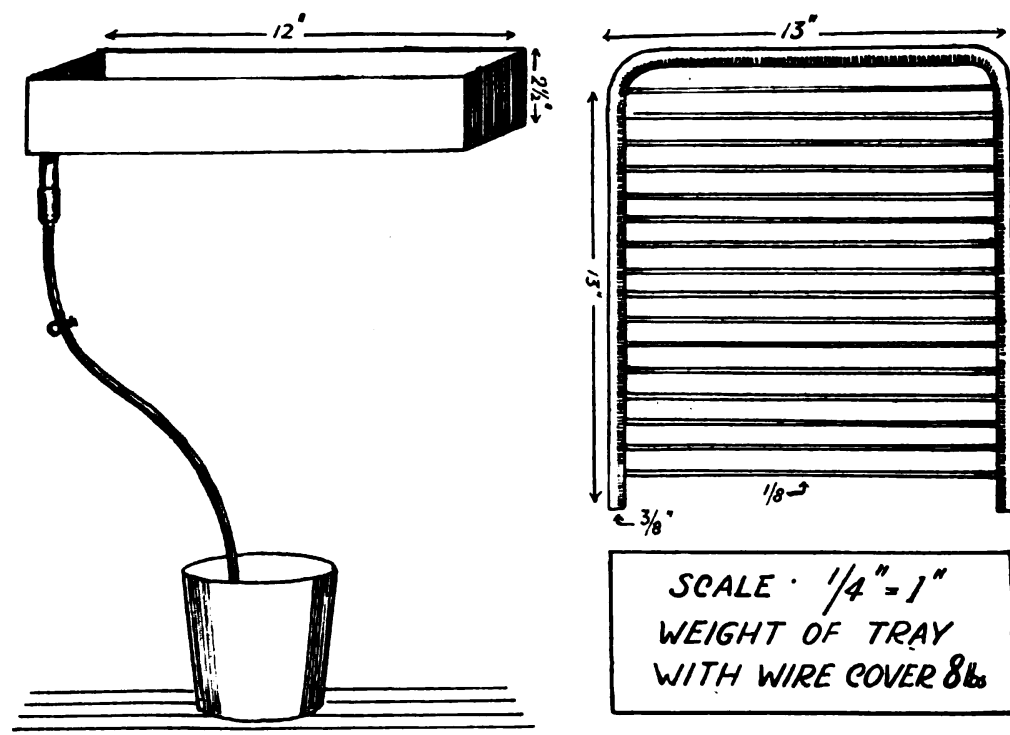
This unit has proved a help in the field. It has provided a clean, flyproof, dustproof surgery, and has provided it at the place and time such facilities were needed—on the beach and immediately accessible.

DEBRIDEMENT UNIT

CHARLES E. BALDREE, JR.
Lieutenant Commander (MC) U.S.N.R.

A search of commercial surgical supply houses over 14 months ago failed to reveal any debridement unit similar to the one about to be described. The entire device can be made aboard ship, ours being made from several pieces of stainless steel metal which were gathered from about the ship. In making this, metal is used which otherwise would be discarded, and a useful device is obtained which would be used many times if it were part of the permanent equipment. The dimensions of the tray can be altered to any size desired.

The basin can be filled with sterile water, surgical soap, and sponges for the initial cleaning of a wound, by clamping the rubber tubing. The waste liquid is carried out of the operator's field to a drain or bucket by releasing the clamp. The tray over the basin covered with a towel affords a surface upon which the part being debrided may be placed. Continuous irrigation can be carried out, and the excess saline drained.



Debridement unit.

This device can be used for the upper and lower extremities as well as for injuries about the face and scalp if continuous irrigation is desired. It serves a dual purpose, acting initially as a basin and later as a collecting tray. This one tray serves the purpose of three or more basins, thus curtailing storage space. The entire device weighs about 8 pounds, is easily moved about and rests securely on a leg or arm board.

Further advantages of this device are: 1. It can be made by utilizing scrap metal. 2. The screen and basin are easily cleansed and sterilized, can be wrapped, autoclaved, and always kept ready for use. 3. The ease and satisfaction with which this device can be used encourages the more liberal use of saline, hence insuring a more thorough debridement. 4. It saves toweling and sponges and keeps the operating region free of excess fluid.



SIGNIFICANCE OF ENLARGED LYMPH NODES

The procedure of finding the significance of enlarged lymph nodes encountered in the examination of a patient constitutes one of the important chapters in physical diagnosis.

Following are some examples of possible sources of error: A mixed tumor of the parotid salivary gland; inflammation of the submaxillary salivary gland or of the parotid; an adenoma of the thyroid gland or aberrant thyroid adenomas; femoral, inguinal, and bladder hernias; in women, accessory breast tissue of the tail of the breast in the axilla; in women the pseudolipoma of the supraclavicular region; von Recklinghausen's multiple neurofibromatosis may present beading along nerve trunks of neck, axillae, or inner surface of the arms, or in the groins; and exostoses of the humerus in the epitrochlear region.

Granted that what is felt is a lymph node, it is important to be able to distinguish between a node that may be said to be actually enlarged, and one that is merely palpable. It is important to remember that lymph nodes are palpable in many normal persons, especially those who are somewhat thin. This by no means necessarily signifies that there is anything wrong with the patient. One has to learn to appreciate the difference between the flattened bean shape and soft consistence of a normal node, and the beginning globularity or nodularity, and usually increased consistence, of an abnormal node.—CRAVER, L. F.: Significance of enlarged lymph nodes. *Am. J. Digest. Dis.* 11: 65-70, March, 1944.

A TIME-SAVING COMBINATION SLING¹

FRANCIS C. LUTZ

Lieutenant Commander (MC) U.S.N.R.

and

HAROLD Y. D. BONSOLE

Lieutenant (DC) U.S.N.R.

On some ships the main sickbay and hospital area are located on the second deck; consequently, most stretcher cases must be transported to that deck from the main deck. Two methods of transportation are available; by hatchways and ladders or by an inboard trunk hatch, 6 feet by 9 feet, with a block and tackle arrangement to lower the stretchers. The first method was discarded because small hatchways and steep ladders lacked space for maneuvering. The second method was found more efficient and more comfortable for patients.

Pontoon hatchcovers were placed in the trunk hatch on a level with the second deck. A single door, 48 inches by 80 inches, was cut into the bulkhead for communication between the sickbay area and the hatch. This door was hinged in such a manner as to allow it to open into the hatch and to lie flat against the bulkhead. This provided access into the hatch and simplified the receiving of stretchers from the main deck through the hatch.

Two methods of lowering the stretchers were available; by electric winch and by manpower. The electric winch proved to be unreliable, therefore a team was organized to handle the operation by manpower.

The rig consisted of a sling for the stretchers. The sling hung from a double purchase block which in turn was attached to a pad eye in the overhead. After this method was tried, it was found that wounded carried from the beach and from the ship did not all arrive in the same type of stretcher; hence valuable time was lost in changing the sling from the type used for the Stokes stretcher to that used for the Army-type pole litter. To prevent confusion and loss of time, a combination sling was devised to accommodate either type of stretcher.

The accompanying sketch is self-explanatory.

¹ Credit is due John George Krabacher, Chief Boatswain's Mate (AA), for his co-operation.



Length of longest legs is 4 feet 6 inches from bottom of splice to throat—all equal length for use with Army pole-type litter. Length of that part of sling used for Stokes litters: Head-end legs are 2 inches longer than foot-end legs, which are 3 feet measured from throat to bottom of thimble splice. The shackle is three-eighths of an inch. All legs are made of 2-inch manila. Eyes on the bottom of Army-type litter legs are made to fit tightly over stretcher legs to insure safety. The pad eye above the throat seizing is served with leather.

COMMENTS

The two legs to be attached to the foot end of the Stokes stretcher were made slightly shorter than those at the head. This was found to be advantageous in cases of shock and it had no ill effect on patients who were not in shock.

The sling is simple in construction, can be made aboard ship, and saves labor and time in the transportation of the injured. There is, then, no necessity of transferring an already shocked and suffering patient from one type of stretcher to another.

EXERCISING DEVICE FOR INCREASING JOINT ACTION

LOUIS B. NEWMAN

Lieutenant Commander (MC) U.S.N.R.

The speed of recovery and the amount of residual disability depend not only on the part played by the physical therapy technician but also on what the patient does to aid in his recovery. When limitation in range of motion of a joint, whether due to disease, injury, or immobilization from casts, splints, or other devices exists, early careful and intelligent motion should be instituted.

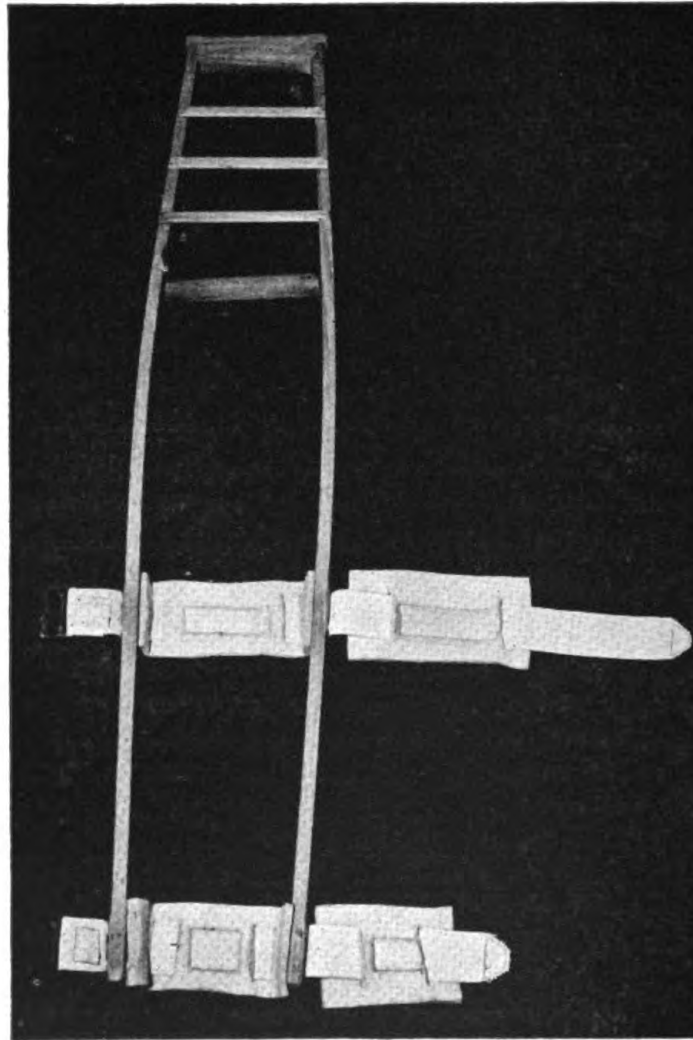
Tissues when heated become soft and pliable, spasm is diminished, and pain is decreased. During this stage maximum beneficial results can be secured to increase the range of motion of an extremity in the shortest time. Fatigue is delayed, for during this period of maximum hyperemia its products are carried off rapidly.

The exercising device described here will aid in securing maximum joint action in less time and with minimum disability and yet permit the patient to take an active part in his own recovery.

Parts of discarded broken crutches have been used to make this joint exerciser. However, the device can be made of strips of wood and when not used in conjunction with diathermy, can be made of metal. This device can be used not only during the application of heat to the involved joint but at any time it is desired to exercise the joint and thereby increase its range and strength. The patient can sit in a chair or on the edge of the table while being treated or while exercising. In many cases the final disability has been reduced to a minimum when this proper and necessary aid has been instituted early during the convalescent period.

Two adjustable well padded straps are fastened to the side members of the exerciser (fig. 1) so that when it is applied to the affected leg, the upper strap can be secured just below the knee and the lower strap just above the ankle (fig. 2).

After securing the exerciser to the leg, the extremity can be placed in the hydrotherapy tank, under a radiant heater or in the field of diathermy applicators. The side members of the exerciser can be made to extend beyond the bottom of the foot and have small rollers attached when it is desired to support the foot and yet maintain easy motion. Another alternative is to strap the rear section of the ordinary roller skate having two rollers to the foot to aid in the back and forth motion with a minimum of effort.



1. Exerciser showing adjustable straps.

With the device, it is evident that active assistive, active resistive, and passive (relaxed) motion can be applied to the extremity not only to increase the range of motion but to improve muscle strength.

An elastic strip (section of discarded automobile inner tube) or coiled spring can be attached to the exerciser (fig. 3) to increase the force aiding flexion of the limb, or the strip of elastic can be brought from the exerciser toward the patient to increase the force aiding extension.

The elastic will be found very satisfactory in converting the device into a resistive exerciser. The amount of pull of the elastic can be controlled by varying the width of the strip of elastic. The three narrow strips of wood at the upper end of the exerciser provide various positions for placing the elastic strips to change the radius through which the force is applied.



2. Showing application of straps below knee and above ankle.



3. Use in hydrotherapy tank, with aid of elastic traction.

It is readily seen that the exact amount of force applied and the range through which the joint is moved is controlled by the patient, when he grips the top of the exerciser. Movements should be slow, rhythmic and just to the point of pain. Rapid, jerky, painful movements should be avoided at all times as this merely irritates an already painful extremity.

In cases in which the range of motion of the joint is diminished because of muscle atrophy and weakness, the passive motion which can be produced with this exerciser will impress the patient with the motion that is possible and which should be sought. However the patient should be made to realize at the very start of his treatments that nothing can substitute for his own active movements to increase the strength of the muscles which have become atrophied from inactivity or injury. This exerciser has proved its value in aiding weak muscles to overcome the resistance of a stiff joint, and in aiding in the development of the adjacent muscles. A device of similar construction can be made for use on other involved joints.

The exerciser is simple, easily constructed, and aids in increasing the range of motion and strength of an injured extremity. Active assistive and resistive as well as passive (relaxed) motion can be instituted with ease and safety and is under satisfactory control at all times, resulting in a shortened period of convalescence and a minimum of permanent disability.

EMERGENCY SURGICAL SPOTLIGHT

MARKLEY C. CAMERON

Commander (MC) U.S.N.R.

A portable stand spotlight is a necessary and useful piece of operating room equipment found in practically all civilian as well as

Naval hospitals. This is not true of ships afloat, where their use is just as necessary. A spotlight, independent of the ship's power, which could be used for surgical procedures when all other sources of light fail would be particularly valuable. Flashlights and battle lights held by unsteady hands are poor substitutes.

The purpose of this paper is to describe a portable emergency spotlight made through the combined efforts of the electric and machine shop departments of this ship.

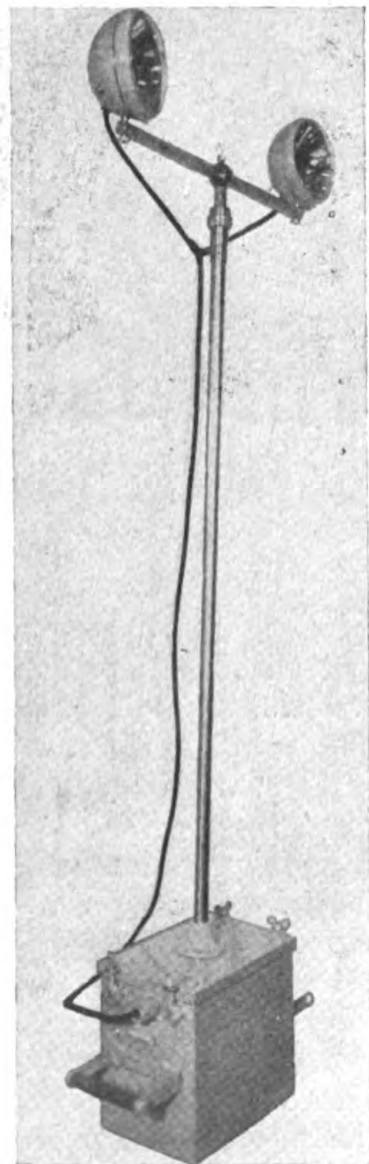
The lights were obtained from the electric shop and were parts of standard equipment. They were two 6-8 volt sealed beam lamp units taken from portable flood lanterns, stock number 17-4-7765; spec. 17L17 (Int.). The lamps are mounted on a bar about 17 inches apart and can be rotated in a horizontal as well as a vertical plane so that they may be focused on one spot for concentrated illumination or used separately as desired.

The lamp unit is mounted on an adjustable standard, which in turn is mounted on the cover of the battery box. The lamps are powered by a 50 A.H. Exide storage battery which is contained in a lead-lined box. The box plus the weight of the battery makes

a very stable base and yet allows for portability.

The storage battery, with these particular lamps, is capable of giving 5 hours of continuous use.

Credit and thanks are given to Chief Electrician R. H. Coffey, U.S.N., and Chief Machinist L. H. Barr, U.S.N., for their efforts in the construction of this spotlight.

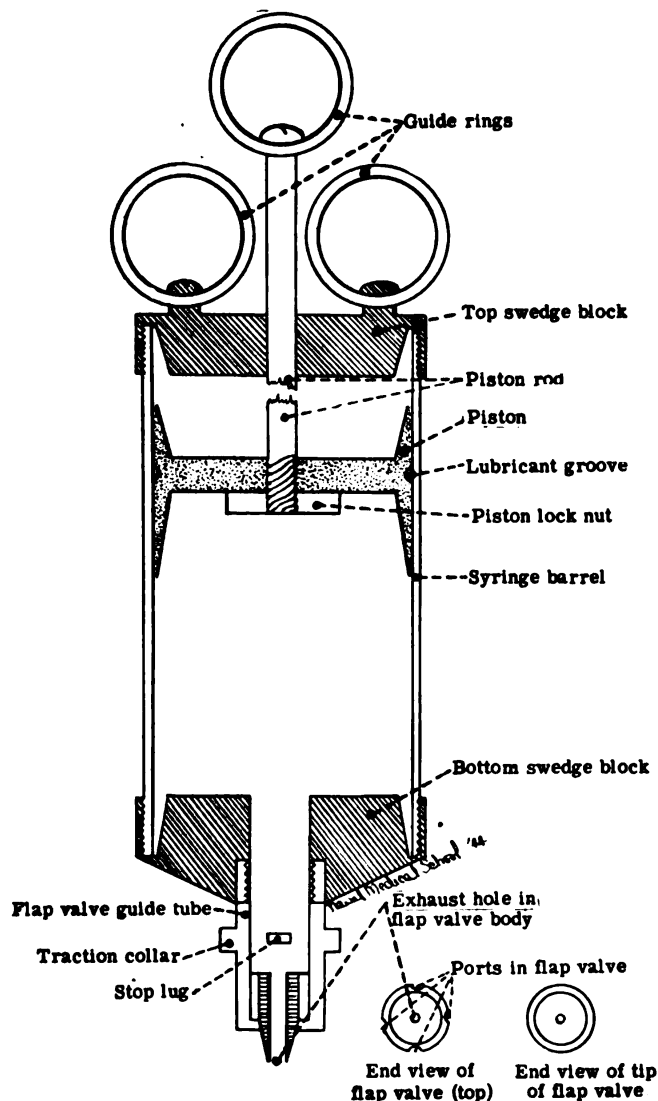


QUICK-FILLING IRRIGATING SYRINGE

TRUMAN O. ANDERSON
Lieutenant Commander (MC) U.S.N.R.

There are three objections to the standard metal irrigating syringe, i.e., slow charging, leakage, and stiffness in operation. To overcome these features, the following modifications have been designed.

1. To eliminate the objection of slow charging, a flap valve is incorporated in the irrigating tip, so that when the piston is pulled up to fill the syringe, the valve body is drawn halfway up the



Quick-filling irrigating syringe.

cylindrical tip. This opens the valve ports and permits an increased volume of water to enter the barrel of the syringe. When the piston is at the top of the barrel and pressure is made to eject the irrigating solution, reversing the flow of solution causes the valve body to return to the end of the cylindrical tip where it seats. The irrigating fluid then passes through the drilled hole in the center of the valve body.

2. To overcome leakage of water or air around the piston, the piston is countersunk on both end surfaces. The circumference cylinders thus formed are featheredged. When the piston is drawn to either end of the barrel, the wedged end plugs serve as swedges to expand the featheredges of the piston and keep them in contact with the cylinder walls.

3. A groove turned in the surface of the piston at the middle circumference of the cylinders provides space for a lubricant to reduce friction of the piston on the cylinder walls and thus overcome stiffness.



RATIONALE OF FEEDING RATHER THAN STARVING PATIENTS
WITH SEVERE HEMATEMESIS OR MELENA

1. Withholding food and drink does not rest stomach, as strongest peristaltic waves occur when stomach is empty.
2. Marked shortening of clotting time during absorption of mixed meals, due only to the protein fraction of the foods.
3. Patients starved 24 or 48 hours much more likely to bleed again than patients fed at once.
4.
 - a. Exhausted patients die after hemorrhage in spite of scrupulous dieting.
 - b. Patients with protracted hemorrhage sometimes stop bleeding when given food.
 - c. Ambulant patients frequently recover from severe melena without making any change in diet.
 - d. Marked reduction in mortality (1935, 1939).
5. The presence of food in the stomach increases the tone and the stomach maintains a constant and continuous pressure on its contents. This increase in pressure tends to close an open vessel and promotes clot formation.
6. Regeneration of blood occurs much more rapidly with the administration of food.
7. Convalescence is shortened.—SCHIFF, L.: Treatment of bleeding peptic ulcer; with report of 160 cases treated by prompt feeding program. *South. M. J.* 37: 335-342, June 1944.

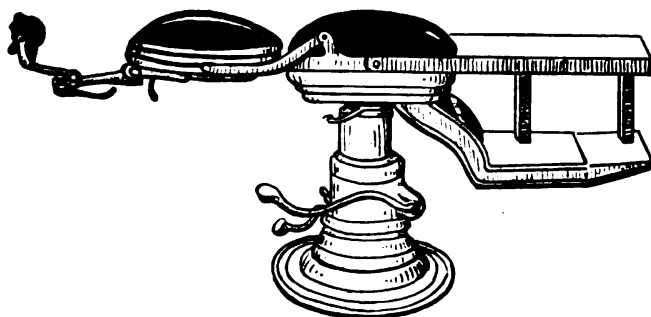
DENTAL CHAIR AS AUXILIARY OPERATING TABLE

HENRY H. HALL

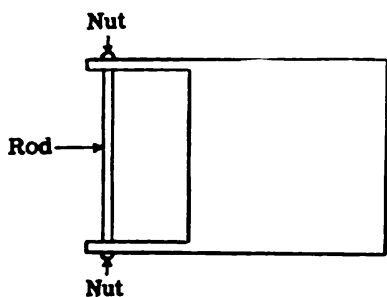
Lieutenant Commander (DC) U.S.N.R.

On some ships, and especially amphibious transports, fresh casualties are often taken aboard, several hundred at a time. Operating space is then too limited. At times like this the dental office is usually closed, whereas it might readily be utilized for cases in which major surgery is not required. Two operations are often performed at the same time in the main operating room, one on the main operating table and the other on a wheel stretcher, while the dental office remains empty or is used only for minor dressings. Operating on a wheel stretcher is not too satisfactory either from the standpoint of the surgeon or the psychologic effect on the patient. The main x-ray unit is frequently in the operating room and causes a bottleneck whenever a roentgenogram is needed, which may be frequently with the many fractures encountered.

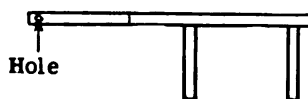
The dental office provides a room already equipped with a sterilizer, running water, a good operating light, aspirator, convenient



Dental chair showing extension in position



View of extension from above



View of extension from the side.

Naval Medical School 1944

instrument tray, x-ray facilities, and in the majority of cases, close access to the sickbay and main operating room.

In order to utilize the dental office as an auxiliary operating room during an emergency, the dental chair can be extended full length and converted into an auxiliary operating table. The dental chair can be raised, lowered, tilted, or turned; with an extension, although it does not compare with a regular operating table, it is more adjustable than many of the flat, stationary tables used in dressing rooms.

The method of adapting the dental chair is as follows:

1. The armpieces of a dental chair are detached and the back of the chair is lowered.

2. A piece of sheet metal is cut to extend from the edge of the seat long enough so that the over-all length of the chair is about $6\frac{1}{2}$ feet.

3. From the sides of this piece of sheet metal, side pieces are made to extend along the side of the chair to the point from which the armpieces are detached.

4. A hole is drilled at this point in the side piece on each side, and a rod inserted through the chair with a nut on each side to hold it in place.

5. For support at the other end, a metal framework is made to rest on the footboard of the chair. The result is a full-length table as completely adjustable as the dental chair.

6. The headrest can be set and moved up or down to adjust to the patient's height. It is comfortable to the patient even when in a prone position. On stretching out the patient's body is almost straight.

7. The dental operating light can be directed on any part of the body.

The extension described is simple to attach and takes a little more than a minute to adjust.

A patient can be transferred easily from a stretcher to the dental-chair table.

In the same manner the dental chair can be adapted as an x-ray table, especially for roentgenograms of the leg, because the dental x-ray unit can be swung into any position over the chair.

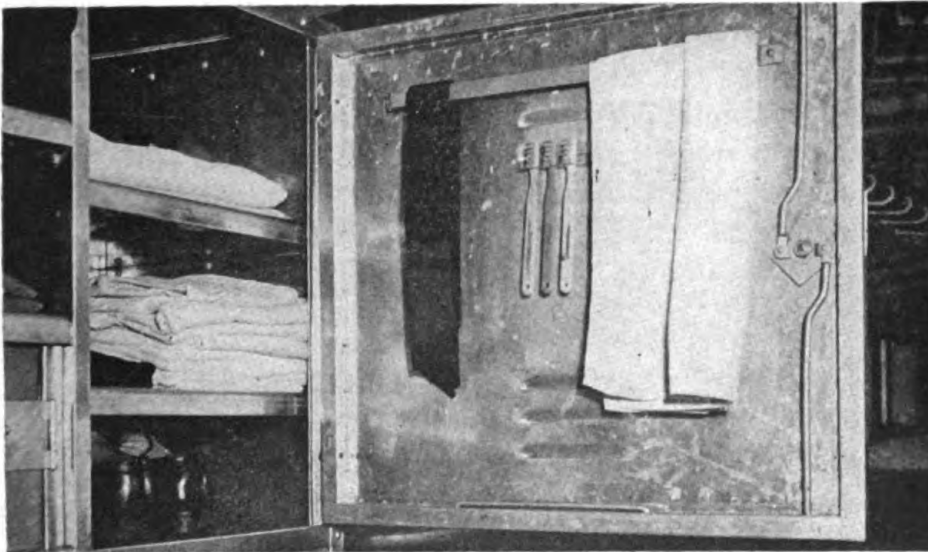
When not in use the extension is easily secured in a corner of the office.

TOOTHBRUSH BRACKET

MERRITTE M. MAXWELL
Commander (DC) U.S.N.

The problem of stowing toothbrushes has been solved by a bracket as illustrated in the accompanying photograph.

During a specific period the dental activity of one ship administered 321 treatments for gingivitis and 1,958 treatments for Vincent's infection. It is obvious from these figures that periodontal lesions in varying degrees of severity may seriously influence the physical and psychologic well-being of personnel aboard naval vessels.



Toothbrush bracket installed in each locker. The bracket provides space for three brushes instead of the usual single brush. It has been placed within easy reach to encourage the use of the brushes which are also thus readily available for inspection. The bracket is placed directly in front of the locker air vent, so that the brushes will have been dried before they are used again.

In considering the treatment problems as applied to periodontal disease, the oral hygiene of the patient is always an important factor. The maintenance of high tissue resistance depends on nutrition, adequate dental treatment, inherent individual factors, and application of a sound procedure of toothbrushing.

EDITORIALS

THE POSTCHOLECYSTECTOMY SYNDROME

Frequently the removal of the gallbladder is followed by acute symptoms identical with those existing prior to operation. Such episodes are disconcerting to the surgeon and discouraging to the patient.

It has been stated that approximately one-third of all cholecystectomized patients are so affected, their chief complaints being of colicky attacks, upper abdominal pain and distressing epigastric pressure. The syndrome is particularly common where the pre-surgical complaints were of a functional disturbance. Surgical exploration of these patients revealed the absence of any pathologic lesion or the presence of only a noncalculus cholecystitis.

Discussing the causative factor of this syndrome Colp¹ attributes it to a dyskinesis of the choledochal sphincter mechanism and states that the spasm may be stimulated either by local or intra-biliary causes. Such factors as recurrent or residual calculosis of the cystic or common bile duct, partial traumatic stricture of the choledochus, cholangitis, pancreatitis, psychic disturbances, glandular dyscrasias or spasms of the colon are listed as agents initiating the attacks.

Treatment consequently has been directed primarily toward these sources, employing principally antispasmodic drugs. Unfortunately these drugs are not always successful in relaxing a spastic sphincter, particularly when there is evident emotional excitement. With failure of relief by medical means, surgical exploration has been advocated.

In the absence of other findings or in conjunction with certain pathologic processes, Colp recommends a sectioning of the sphincter fibers and has designed a sphincterotome which is introduced endocholedocally down through the papilla of Vater. The sphincter musculature is divided as the instrument is withdrawn.

The success in relieving in this manner the troublesome syndrome may warrant the adoption of this procedure at the time of the primary gallbladder operation except where specifically contraindicated. The procedure is simple and has an analogy in the

¹ COLP, R.: Postcholecystectomy syndrome and its treatment. Bull. New York Acad. Med. 20: 203-219, April 1944.

Rammstedt's pylorotomy. Certainly without such a step the responsibility is upon the surgeon to inform the patient of the possibility of a postcholecystectomy syndrome following any gallbladder surgery.

GAS GANGRENE

Gas gangrene is one of the most serious complications of war wounds. During World War I, 80 percent of all wounds gave positive cultures of clostridia, and 10 percent demonstrated clinical gangrene¹. The percentage incidence during the present conflict is difficult to appraise, but from a survey of the literature it must be concluded that gas gangrene is not a major problem. MacLennan² observed that during the Middle East campaign 20 to 30 percent of the battle wounds contained culturable clostridia but only .32 percent of these developed clinical manifestations. Of 3,333 battle casualties aboard a hospital ship during a 6-month period only 5 cases of proved gas gangrene were encountered, whereas in the Solomon Islands campaign 32 cases were reported. In the Dieppe raid we are told¹ that 3 percent of the casualties developed gangrene. The data from other theaters of operation coincide for the most part with these reports.

Some have been inclined to believe that the nature of the battle terrain has contributed much to this lessened incidence. Analysis however of this postulate reveals little to substantiate the claim. Certainly the war as fought in Abyssinia, the isles of the Pacific and the Naval engagements at sea would lend credence to this contention, but the Chinese, Russian, African and Italian campaigns have all been waged in highly seeded areas where fields have been heavily cultivated throughout centuries. Moreover, the occurrence of gangrene in the Naval flyer who bailed out over the Caribbean sustaining a compound fracture on contact with the sea and who was conveyed directly to the hospital, throws considerable doubt upon terrain as an important factor.

On the other hand, some maintain that the present high velocity projectiles do not tend to create conditions favorable for gas gangrene. This may be true of the smaller-gage arms but the appalling mutilations created by shell and bomb fragments militate against this opinion.

¹ NEEL, H. B., and COLE, J. P.: Gas gangrene in amphibious warfare in Pacific area. In press.

² MACLENNAN, J. D.: Anaerobic infections of war wounds in Middle East. *Lancet* 2: 63, July 17, 1943; 94, July 24, 1943; 123, July 31, 1943.

From a study of the relationship between clostridial contamination of wounds and clinical gangrene one is impressed with the apparently static proportional character of the infection whether World War I or II be reviewed; roughly 10 percent of contaminated cases develop clinical gangrene. This brings up a review of factors seemingly required before invasion of the disease becomes manifest.

MacLennan observed that the ubiquity of anaerobic bacteria renders their presence in a wound a matter of probability. In the battle fields of Western Europe any but the most trivial wounds contained clostridia. The presence however of even toxigenic clostridia by themselves does not necessarily imply invasive clinical changes. Something more seems required.

It has been stated³ that in no case in which anaerobic organisms alone were demonstrated has clinical gangrene developed. MacLennan showed that the presence of anaerobic cocci or other clostridia was necessary before a true clinical picture of gas infection occurred in the wounded of the Middle East. Furthermore, the complex bacterial entity of gas gangrene is reflected in the fact that the individual case usually presents a mixed bacterial flora of aerobes as well as anaerobes.

This synergism or symbiosis is becoming well established and contributes positively to the prognosis of the disease.

Of the many varieties of gas-producing anaerobic bacteria, however, *Clostridium welchii* continues to be the outstanding offender and the presence of streptococci seems to stimulate astonishingly its growth. Perhaps it is this fact that accounts for whatever success is accredited to chemotherapy in gangrene infections. Certainly sulfonamides alone are of little value from the viewpoint of treatment and the evidence acquired from the administration of penicillin alone, although promising, appears to indicate only a hopeful acclaim.

Furthermore, the recognition of an anaerobic cellulitis of streptococcal origin is significant and introduces a new aspect in differential diagnosis and therapy⁴.

In a recent review⁵ of the therapeutic management of 139 cases of gas gangrene it was shown that all untreated patients succumbed, that 92.4 percent mortality occurred when antitoxin alone was administered, 72.8 percent when surgery alone and 45.4 per-

³ FIROR, W. M.: Prevention and treatment of tetanus. *Am. J. Surg.* 46: 450-453, December 1939.

⁴ MACLENNAN, J. D.: Streptococcal infection of muscle. *Lancet* 1: 582-584, May 8, 1943.

⁵ MACFARLANE, M. G.: Therapeutic value of gas-gangrene antitoxin. *Brit. M. J.* 2: 636-640, November 20, 1943.

cent when surgery and antitoxin were employed. More than 90 percent of these patients had received a sulfonamide drug so that the effectiveness of this type of chemotherapy may be evaluated.

However, the early administration, within six hours of diagnosis, of adequate amounts of antitoxin materially influenced the fatality rate. On the other hand reports^{6, 7} as regards penicillin in gas infections, particularly from a therapeutic approach, appear encouraging and make its use advisable. Again it must be remembered that zinc peroxide as a local dressing even in a severely contaminated wound is a valuable adjunct and has a definite inhibitory action upon the progress of gas gangrene⁸.

Kelly and Dowell⁹ assembled the data on twelve years of roentgen treatment of gas gangrene and concluded that with irradiation the disease need no longer be considered serious. Similar claims were reiterated recently¹⁰. Studies however by the subcommittee on Radiology of the National Research Council were unable to substantiate Kelly's enthusiasm and found that x-ray at best, was only of an auxiliary value.

A prospectus of this nature emphasizes the seriousness of gas infection, its complex character and the unequivocal importance of early administration of the several therapeutic aids, surgery, antitoxin and chemotherapy. It must not be overlooked that combined therapy seems to have an additive or synergistic effect and undoubtedly offers the greatest possibility of therapeutic success.

⁶ MCKNIGHT, W. B.; LOEWENBERG, R. D.; and WRIGHT, V. L.: Penicillin in gas gangrene; report of successfully treated case. J.A.M.A. 124: 360, February 5, 1944.

⁷ Abstract of manuscript to be published. Gas gangrene. OEMcmr-48, May 6, 1944.

⁸ CALDWELL, G. A., and COX, F. J.: Gas gangrene: Experimental observations on use of sulfonamide derivatives and zinc peroxide in its treatment and prevention. South. M. J. 35: 789-796, September 1942.

⁹ KELLY, J. F., and DOWELL, D. A.: Twelve-year review of x-ray therapy of gas gangrene. Radiology 37: 421-439, October 1941.

¹⁰ Current comment: Roentgen therapy of gas gangrene. J.A.M.A. 124: 651, March 4, 1944.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

PRINCIPLES AND PRACTICE OF AVIATION MEDICINE, by *Harry G. Armstrong, M.D., F.A.C.P., Colonel, Medical Corps, United States Army*. Second edition. 514 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$6.50.

This volume, first published November 1939, has been reprinted four times. A second revised edition, brought up to date, was released in 1943. This gives testimony of its generally accepted value to the science of aviation that is far more impressive than any word picture an appreciative reviewer might be able to present. It is known throughout the civilized world and is used as a text in the schools of Aviation Medicine of both the United States Navy and Army.

Although eminently scientific throughout, the author has studiously avoided the use of confusing algebraic equations and statements of involved laws of physics. The subject matter has been presented in such an orderly and interesting manner and in such simple phraseology that it is well within the mental grasp of the average doctor whose college days are so far behind that the art of knowing how to study has almost been lost.

From the condensed historical sketch of Aviation Medicine found in chapter one to the last chapter on Aerial Relief and Sanitation, this book is exactly what its title indicates. The author states at the outset that many important pertinent facts and findings have been omitted because of their restricted nature during time of war. Any glaring omissions are due to this cause.

Four chapters are devoted to physical examinations of pilots and include examination of the eye, cardiovascular system, ear, nose and throat, and general physical examination. A detailed

account is given of the various diagnostic apparatuses in use. The chapter on Aerial Equilibration and Orientation represents knowledge gleaned from long careful observation under actual flying conditions. Attention is given to airsickness and to acute and chronic altitude sickness. The all-important use of oxygen in aviation is discussed in detail as are also the effects, immediate and resultant, of decreased atmospheric pressures. The subject of aero-embolism, its occurrence, symptomatology, pathologic physiology, and treatment is covered in a masterful manner. Ample space is given to consideration of accidents in aviation and causes of pilot failure and also to the emotional reactions to flight which include the psychoneuroses, emotional shock and anxiety states.

Many well chosen photographs and drawings give visual assistance in proper interpretation of the text.

It is recommended that this book be read by all pilots as well as by all medical men, even those not directly associated with aviation. It is printed in clear, bold type.

Each chapter is followed by a well chosen bibliography and is a source of ready reference for the inquisitive mind. A complete index in the back of the volume is a master key to the storehouse of information in the preceding pages.

BACKACHE AND SCIATIC NEURITIS, Back Injuries—Deformities—Diseases—Disabilities, with Notes on the Pelvis, Neck, and Brachial Neuritis, by Philip Lewin, M.D., F.A.C.S., Associate Professor of Bone and Joint Surgery, Northwestern University Medical School, Chicago; Lieutenant Colonel, Medical Corps, U. S. Army. Line drawings by Harold Laufman, M.D., Instructor in Surgery, Northwestern University Medical School, Chicago; Captain, Medical Corps, U. S. Army. 745 pages; illustrated with 235 figures. Lea & Febiger, Philadelphia, Pa., publishers, 1943. Price \$10.

The author has published an excellent presentation on the subject of backache and sciatica. In fact, the subject title is somewhat modest in that practically the entire orthopedics of the back, spine, pelvis and extremities, together with the corresponding neurology, is comprehensively covered. From embryology and anatomy to clinical signs and treatment, conditions resulting not only in backache and sciatica, but many other symptoms are exceedingly well described. The work is well supported by clear headings, charts, diagrams, figures, photographs and x-ray reproductions. The material is so presented that it makes an excellent reference and textbook for the student, general practitioner, internist and surgeon.

Treatment is discussed under each topic; for many conditions several types of treatment, both conservative and operative, are given in detail, and these are often illustrated. Causes and treat-

ment for chronic sprain, strain and postural defects are given; acute injuries of the spine are presented in detail, and certain syndromes, such as scalenus anticus, herniated disc, lumbo-sacral and sacro-iliac disorders are presented in such a way that the reader would not only become familiar with the condition, but know in detail in what manner to proceed with treatment and management.

Of particular interest in these times are the chapters on back disorders in the military services, traumatic, compensation and war neuroses, and traumatic and industrial causes of backache.

The only criticism of the work might be that it would be a bit too comprehensive, and therefore disappointing to him who, on seeing the title, would seek a simple cause and a quick treatment for "backache and sciatica." However, it is believed that such a student would find, as compensation for his efforts, a well-rounded education in practical orthopedics of the back and the neurology concerned in conditions in which backache and sciatic pain are the principle and presenting symptoms. It is the writer's opinion that a diligent study of the book will help materially in taking these symptoms out of the realm of the less well understood, and cause them to be treated on a more rational and surgically sound basis.

MINOR SURGERY, by *Frederick Christopher, S.B., M.D., F.A.C.S., Associate Professor of Surgery at Northwestern University Medical School, Chicago, Chief Surgeon at the Evanston (Ill.) Hospital.* Fifth edition, reset. 1006 pages; 575 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price \$10.

In 1929 this masterly volume on minor surgery first came off the press. Since that time the number of reprintings and resettings attest its popularity and worth. The prodigious review of the literature is apparent even to the casual reader.

Comparisons however of the present with earlier editions disclose changes of such minor character as to reflect upon the expediency of putting out an edition of this type during these times of dire paper shortage.

The outstanding contribution to this edition and presumably the reason for its issuance is the chapter on Preoperative and Post-operative Care. Admittedly a valuable asset to the work, this chapter complements the ones on Minor Surgical Technic and Surgical Interne. Its 47 pages constitute a valuable practical guide in patient management for interns, hospital attendants, and young medical practitioners.

Regardless of the importance of the subject matter, the generous use of illustrations and the good quality of paper make this book

an attractive, readable volume, one that warrants its possession by anyone interested in surgery.

TRAUMATIC INJURIES OF FACIAL BONES, An Atlas of Treatment, by *John B. Erich, M.S., D.D.S., M.D., Consultant in Laryngology, Oral and Plastic Surgery at the Mayo Clinic; and Louie T. Austin, D.D.S., F.A.C.D., Head of Section on Dental Surgery at the Mayo Clinic; in collaboration with the Bureau of Medicine and Surgery, U. S. Navy.* 600 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price \$6.

This book is an exceptionally fine treatise on the subject; it is well illustrated and uniquely enough, opposite each illustration is a description of what is shown in the picture. This facilitates study and understanding of the text.

Much detailed instruction is wisely given in the construction and application of plaster head casts. This subject is timely and capably presented.

Throughout the book photographs of devices shown in the oral and plastic surgery exhibit of the Mayo Foundation are shown. Many are now familiar with these appliances but their use is described in detail and shown often in use in practical cases.

The book is a valuable aid and will be extremely useful as a reference for those required to treat maxillofacial injuries.

GASTRO-ENTEROLOGY, by *Henry L. Bockus, M.D., Professor of Gastro-enterology, University of Pennsylvania Graduate School of Medicine; and colleagues at University of Pennsylvania Graduate School of Medicine.* Volume II—The Small and Large Intestine and Peritoneum, Diagnosis and Treatment of Disorders of the Small Intestine, Colon, Peritoneum, Mesentery and Omentum. 975 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price \$35 for 3 volumes and separate desk index.

The second book of this series is indeed a worthy addition to the first volume. The same excellent pattern of complete anatomic, embryologic (including developmental anomalies), and physiologic descriptions are given, along with many appropriate clinical remarks. The clinical approach to the study of diseases of the large and small intestine, the peritoneum, mesentery and omentum is covered and includes history taking, emphasis on important symptoms, laboratory examinations and the most complete discussion of the important diseases in this field (including symptomatology, physical, roentgenologic and laboratory examinations, complications, diagnosis, medical and surgical treatment and prognosis) that this reviewer has ever had the pleasure of reading.

This book is easy and enjoyable reading and is well illustrated with x-ray plates of a good quality, excellent case histories and several color plates. The binding and other physical qualities are very good.

This reviewer knows of no book or books on this very important subject that can compare with the comprehensiveness of the first two volumes of Bockus, retaining at the same time the readability and clinical emphasis present here. Certainly this volume, as well as the first, should be readily available for specialists in this field as well as for all those who treat gastro-intestinal diseases.

OFFICE TREATMENT OF THE NOSE, THROAT & EAR, by *Abraham R. Hollender, M.Sc., M.D., F.A.C.S., Associate Professor of Laryngology, Rhinology and Otolaryngology, University of Illinois College of Medicine*. 480 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1943. Price \$5.

This is a volume in which the author attempts to evaluate systemically otolaryngologic problems and the extent to which they may be properly handled in office practice. He wisely points out that these conditions are in most instances closely associated with the general functioning of the body and with such factors as immunity, endocrines, and nutrition. Consequently he stresses the difference in approach to therapy in the light of the newer concepts of physiology.

The book is illustrated with some fairly good drawings and photographs. Procedures as outlined, although some may be lacking in detail, are a fair guide as to how many of them may be successfully handled within the confines of the office. Perhaps there may be a little over-emphasis on the merits and versatility of short wave diathermy, but most of the acceptable procedures are properly outlined.

The work has many quotations from numerous authors, with references at the end of each chapter. Although not to be construed as an absolute reference guide, it provides a helpful source from which the practitioner may add to his resources in the handling of office problems.

ESSENTIALS OF DERMATOLOGY, by *Norman Tobias, M.D., Senior Instructor in Dermatology, St. Louis University*. Second edition. 497 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price \$4.75.

The second edition of this handbook, which was so favorably received on its first appearance, has been brought up to date by the deletion of obsolete forms of treatment and the addition of sections on such timely dermatologic subjects as vitamin and sulfonamide therapy, about which there has been a great deal of confusion.

Several chapters have been rewritten and many new pertinent illustrations have been added. The photographs have been beautifully reproduced on excellent paper and are good examples of the contents of the text. The arrangement of the subject matter is well done leading to the development of an even flow with no repetitions

or overlapping. The addition of "Tables of Normal Values" and "Don'ts in Dermatology" add greatly to the value of the book.

The author had not intended it to be a textbook for reference or deep study, and with this thought in mind I believe we can safely say that it is about the best handbook of dermatology for students that has yet appeared.

PATHOLOGY AND THERAPY OF RHEUMATIC FEVER, by *Leopold Lichtwitz, M.D., Lately, Chief of the Medical Division of the Montefiore Hospital, and Clinical Professor of Medicine, Columbia University, New York City*; foreword by *William J. Maloney, M.D., LL.D., F.R.S. (Edin.), Consulting Neurologist to the City Hospital; Formerly Professor of Nervous and Mental Disease, Fordham University, New York City*; edited by *Major William Chester, M.C.* 211 pages; illustrated. Grune & Stratton, Inc., New York, publishers, 1943. Price \$4.75.

This book is a review of the published works on rheumatic fever and allied diseases. It has excellent illustrations and a complete bibliography. The author emphasizes the protean character of rheumatic fever and presents a valuable summary of clinical manifestations and anatomic changes. Several chapters deal with arthropathies associated with a great variety of diseases. There is an excellent summary on the incidence of rheumatic fever and the importance of host factors.

This book contains much of interest to students of rheumatic fever and arthritis.

FIGHTING FITNESS, A Premilitary Training Guide, by *C. Ward Crampton, M.D., with the editorial assistance of Ken Littlefield.* 251 pages; illustrated. Whittlesey House, New York, publishers, 1944. Price \$2.

The author deplores the state of the physical fitness program for the American youth, which has been revealed by Selective Service records to be alarming. He points out that rejections for physical defects, even among the 18- to 19-year-olds, have amounted to over 25 percent. And among those admitted to military service, the majority were not in good physical condition.

As his contribution to the correction of this greater or lesser decadence of the health of the nation, the author has presented a number of exercise and body-building routines, which can be accomplished by any citizen. Purporting to appeal, primarily, to teen-age youths, he has created several possible war situations, in which physical stamina is a prerequisite. He continues, showing that any individual's accomplishments or lack of accomplishments are in direct proportion to previous preparation of the body to stand the rigors of combat service.

The material in this book is not particularly well presented. The exercises, while valuable as such, could be listed more concisely,

using much less space and requiring less time to digest. Most of the hypothetical situations, interesting as a whole, leave the reader up in the air, just before the climax is reached, plunging into a series of exercises, which theoretically will prepare a man to cope with any situation.

Without denying that the exercise routines presented are of definite value, one gets the impression from the hypothetical situations, that this is "arm-chair generaling."

FOOTE'S STATE BOARD QUESTIONS AND ANSWERS FOR NURSES, Essay and Objective Types, Compiled From Actual Examination Questions Given Throughout the Country by State Examining Boards, by *an editorial panel of 11 authorities in nursing education*. 22nd edition, 1944 revision. 1159 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price \$3.50.

In reviewing the twenty-second edition of this book, I find it to be a most useful one for those interested in taking the various state board examinations to obtain their registered nurse status.

This new edition presents a valuable article on the explanation of the modern state board examinations, why state board examinations are held, and the different types of examinations. On the inside covers are "Medical Combining Forms" and "Prefixes and Suffixes" which would be most useful for review purposes.

As an instructor in a hospital corps school, I have found this book particularly helpful in formulating test questions.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

INVESTIGATION OF A JAUNDICE EPIDEMIC IN TUNISIA

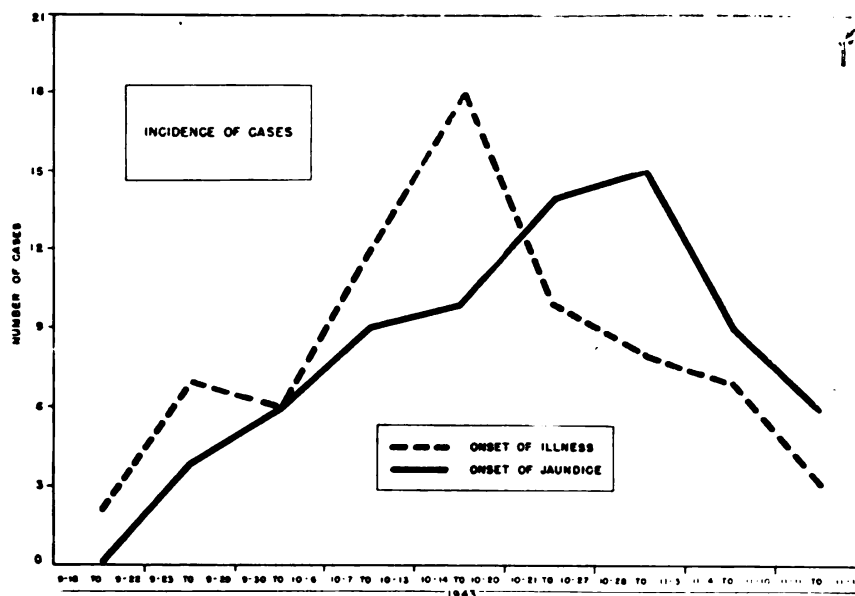
PRELIMINARY REPORT

HORACE M. GEZON

Lieutenant (MC) U.S.N.R.

On 14 October 1943, Epidemiology Unit No. 23¹ was ordered to Bizerte, Tunisia, to investigate recent cases of jaundice at an advance amphibious training base. The purpose of the study was an attempt to (1) determine the type of jaundice found, (2) show the etiologic agent responsible for the outbreak, and (3) institute control measures to check its spread.

The first case of jaundice, in a hospital corpsman, was noted at this base on 10 September 1943. This patient's recovery was rapid and uneventful. During the week of 23 to 29 September four more cases were recognized. Subsequently there was a steady increase



Graph 1.—This shows incidence of cases and relationship of onset of illness to onset of jaundice.

¹ Personnel in Epidemiology Unit No. 23 include the following: Pharmacist's Mate, first class, V. R. Larsen; Pharmacist's Mate, first class, R. H. Chaney; and Pharmacist's Mate, second class, Sam Lavin. Laboratory assistance in this study was given also by Chief Pharmacist's Mate Aaron Solleau.

in the incidence of jaundice, which reached a peak of 15 cases during the week of 28 October to 3 November. For the two weeks 4 November to 18 November there was a rapid fall in the incidence of this disease. This trend may be more clearly shown by graph 1. The time of onset of both the prodromal symptoms and the clinical jaundice are shown in this graph. The total number of cases reported is 73.

The disease followed a typical pattern in most patients with anorexia, nausea and vomiting, chills and fever, headaches, backache, and epigastric distress as the most common prodromal symptoms. These nonspecific symptoms have frequently been interpreted as evidence of acute catarrhal fever. The average duration of the prodromal stage from the time of onset of symptoms to the appearance of icterus was 5.5 days. Concomitant with the onset of jaundice most of the patients began to show signs of improvement. Some however remained acutely ill and continued to show all of the symptoms seen in the prodromal stage. Many had liver enlargement and epigastric or right upper abdominal quadrant tenderness, while relatively few (5.5 percent) had splenic enlargement. None showed any generalized lymphadenopathy. Backache was a late symptom in many patients but also a very persistent one, lasting up to 2 weeks in duration in a few cases. The average duration of clinical jaundice was 16.3 days and that of total illness 22.2 days. The incidence of the clinical symptoms and signs is indicated in table 1.

TABLE 1.—*Symptoms and signs*

<i>Symptoms</i>	Yes	Percent	No	Percent
Abdominal pain.....	65	89.0	8	11.0
Nausea and/or vomiting.....	63	86.2	10	13.8
Anorexia.....	61	83.6	12	16.4
Fever.....	44	60.2	29	39.8
Headache.....	36	49.3	37	50.7
Backache.....	26	35.6	47	64.4
Joint or muscular pains.....	19	26.0	54	74.0
Weakness.....	17	23.3	56	76.7
Pain in eyes.....	12	16.4	61	83.6
Dizziness.....	3	4.1	70	95.9
<i>Signs</i>				
Abdominal tenderness.....	44	60.3	29	39.7
Liver enlargement.....	41	56.1	32	43.9
Splenic enlargement.....	4	5.5	69	94.5

It is our impression that jaundice was more prevalent in the younger rather than older age groups. A comparison of the average age of a random sample of 200 normal men with that of the jaundiced group confirmed this impression. Standard statistical methods were used in the analysis of this data. The results indi-

cate that a significant difference in age exists between the two groups. The calculations are as follows:

	Patients	Controls
Number of cases in series.....	73	200
\bar{X} age.....	24.20 yrs.	26.17 yrs
σ of age distribution.....	5.72	6.92
$S.E. = \sqrt{\frac{\sigma_p^2}{N_p} + \frac{\sigma_c^2}{N_c}}$		
S.E. = 0.70	Note: P Patient series C Control series N _p Number of patients N _c Number of controls	

The difference between XC and XP = 1.97.

This difference is 2.82 times the standard error and is thus statistically significant.

LABORATORY INVESTIGATION

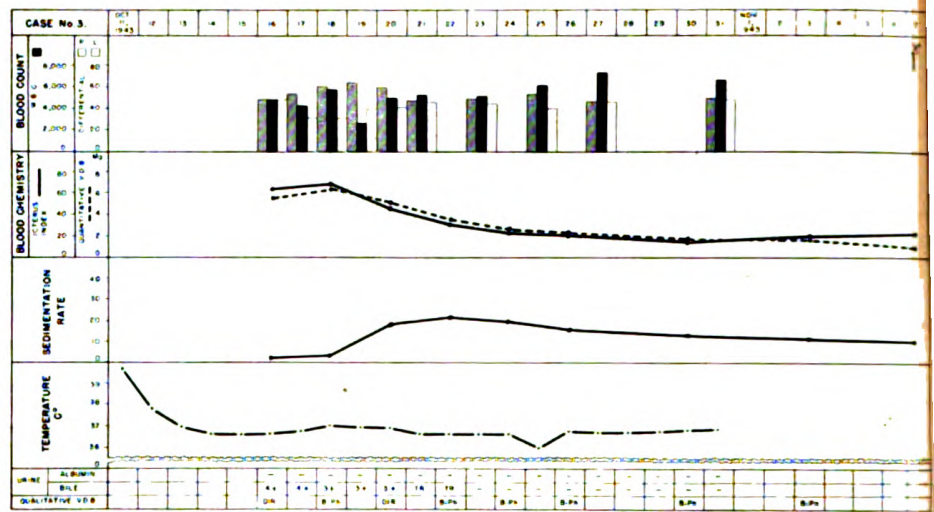
Although a total of 73 patients have been followed clinically, only the first 38 were studied extensively by means of the conventional laboratory methods. The following procedures were carried out on each patient.

1. Daily urinalysis for bile and albumin.
2. Daily white blood cell count and differential count for the first week and then white blood cell count every second to every fourth day.
3. Red blood cell count every fourth day.
4. Two microscopic and bacteriologic stool examinations for ova, parasites, and pathogens.
5. Sedimentation rate every second to fourth day.
6. Qualitative and quantitative van den Bergh tests every second to fourth day.
7. Icterus index every second to fourth day.
8. Three or more serum darkfield examinations.
9. Two or more urine darkfield examinations.
10. Two blood thick smears.
11. Blood culture.

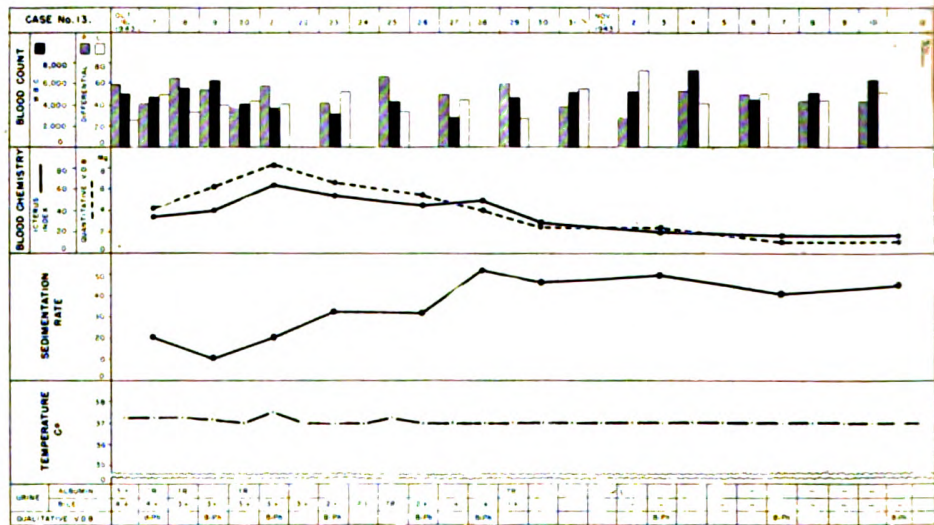
Generalizations derived from data on variables such as leukocyte count, differential count, erythrocyte count, and sedimentation rate on the entire group of patients can be made. Because of the wide variation in disease pattern exhibited by these patients, the application of such generalizations to analysis of the course of the disease in an individual case is, however, not always possible. A more adequate evaluation of a single case can be obtained through study of a chart showing simultaneous variations in clinical data throughout the course of the disease. Two such charts on two representative cases are shown in graphs 2A and 2B.

A summary of certain clinical features common to a majority of the cases studied follows.

For the first few days the majority of the patients had a definite leukopenia with relative lymphocytosis. Most of the patients



Graph 2A.—Showing laboratory and clinical course of case 3.



Graph 2B.—Showing laboratory and clinical course of case 13.

had leukocyte counts as low as 5,000 per cu. mm. Two examples of this are given in the aforementioned graphs. It may be noted that the period of leukopenia in these two patients differed considerably. The erythrocyte count remained fairly constant in most patients. The sedimentation rate was the most variable of all of the findings. No pattern can be obtained from the results, as in some cases the sedimentation rate started in the normal range, rose slowly and then again returned to normal levels (as in case 3, graph 2A), in others the rate remained high during the entire course of the disease (as in case 13, graph 2B), and in others rises and falls occurred apparently completely unrelated to all other findings.

The most puzzling finding in this regard is the presence of a markedly elevated sedimentation rate after the patient appeared to be well clinically; this finding was noted in most of the patients. Inasmuch as the sedimentation rate is usually used as an index of the activity of an infection, it might be assumed that the patient was still in an active phase of the disease when he was considered clinically "cured."

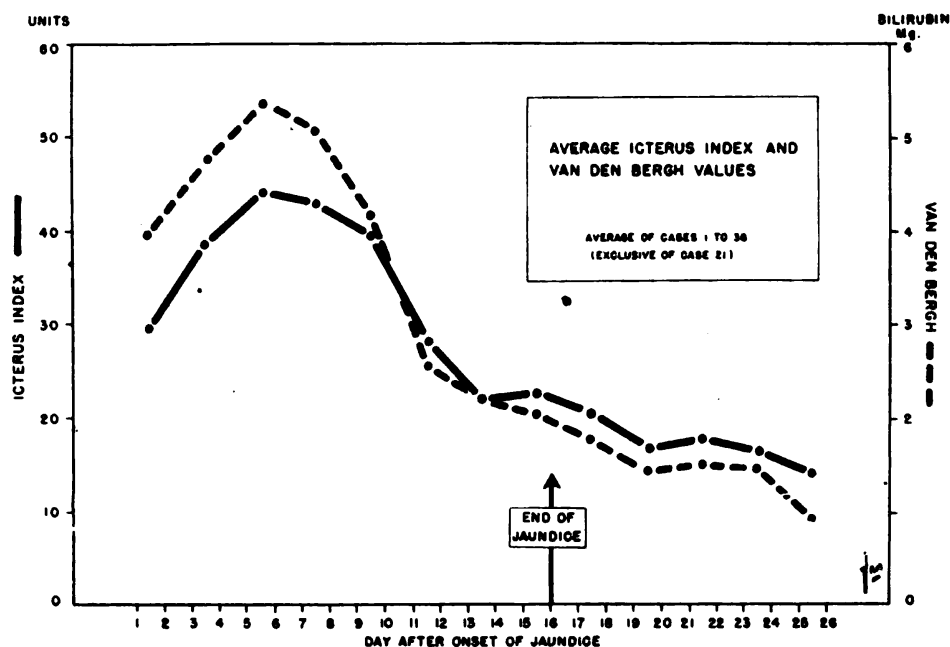
As would be expected the duration of the presence of bile in the urine varied greatly in individual patients. It was detectable for 25 days in one patient and for only one to two days in others. The presence of albumin was usually an unfavorable sign and was noted in only the more acutely ill patients. There was a definite relationship between this finding and the presence of fever.

Examination of the stools showed them to be negative for ova and parasites in every case. *Shigella paradysenteriae* was isolated in the second stool culture on case No. 13 and was associated with clinical symptoms of diarrhea. All other stool cultures were negative for pathogens.

The relationship between clinical jaundice and serum icterus index and serum bilirubin is shown in graph 3, a graph of the average values of all of the 38 cases except case No. 21. Data from this case were obtainable only during the latter half of the course of the disease. For this reason the inclusion of this with that of the other patients in the group seemed inadvisable. A maximum icterus index of 115 units and a quantitative van den Bergh reading of 11.5 mg. bilirubin were obtained in this case.

It may be noted in both the graph of the average values and the graphs of the individual cases that there is a close correlation between the bilirubin values and the icterus indices. The values for both the icterus index and serum bilirubin were surprisingly high on the day of onset of clinical icterus; the average value for the former is 27.6 units and the latter is 4.1 mg. bilirubin. Qualitative van den Bergh reactions were biphasic during the entire course of the disease in most patients. A few direct reactions were obtained in some of the cases with unusually high serum bilirubin levels during the first few days of the illness, but these, too, soon became biphasic and remained so for the duration of the illness.

Blood culture findings should be considered negative on all patients, although 14 of the initial cultures revealed the presence of an organism. Repeated cultures on these 14 patients were negative and it may be assumed that one lot of media was improperly sterilized. The presence of several different gram-positive cocci



Graph 3.—Average relationship between clinical jaundice and laboratory indices.

and bacilli is further evidence indicating that such positive findings are of no significance.

At least two blood thick smears stained with Geimsa's stain were obtained on each patient. These smears were negative for both plasmodia and spirochetes.

One of the most difficult findings to interpret was that of an elongated filament in the serum on darkfield examination. These particles varied in size from $10\ \mu$ to $20\ \mu$ in length and $0.2\ \mu$ to $0.5\ \mu$ in width, and as a rule had knobbed ends. In a few instances filaments were seen with light and dark areas resembling granules. Active Brownian movement, simulating that of a spirochete and suggesting true motility, was seen frequently, but progress of the filament was never observed.

Serum obtained under sterile precautions contained as many particles as that obtained with unsterile technic. Serum allowed to incubate for 24 hours at room temperature or 37°C . showed little change. Serums obtained from 11 apparently normal controls were positive for this same object in all but one instance. Similar filaments were also found in the serums of 2 control guinea pigs, 1 guinea pig injected with patient's blood, and one guinea pig injected with patient's urine.

Numerous attempts were made to demonstrate the filament in stained preparations, using Gram's stain, Giemsa stain (3 to 6 hours) and silver stain (modified Fontana method) but in no case has this been possible. The only explanation we can offer for the

presence of these filaments in serum is that they are normal constituents of the blood, possibly an organic fibril, and that they have no relationship to jaundice. Some additional evidence that they are not leptospira is the fact that they have not been seen in the urine on numerous darkfield examinations. At least two careful examinations on fresh urine sediment were made on each patient. Giemsa and silver stains of sediments were also negative.

Fifteen guinea pigs were obtained from the Pasteur Institute in Tunis. These animals were kept in individual cages well separated from each other, well sheltered from the rain but not well protected from the cold. Seven animals received an intraperitoneal injection of 5 cc. of blood from both convalescent and active cases of jaundice. Two animals were given 5 cc. of sterile urine intraperitoneally from convalescent patients. Six animals were kept as controls. Two of the control guinea pigs were found dead, the first on the eleventh day of the experiment and the second on the twelfth day. Grossly at autopsy both showed evidence of pneumonia and this finding was confirmed on microscopic examination of the tissues. On the eleventh day after injection the two animals injected with blood and urine from case No. 21 showed signs of illness, with weakness, anorexia, and near coma. These animals were sacrificed.

Although all other animals remained healthy, six were sacrificed on the sixteenth day of the experiment and the last five on the seventeenth day. At autopsy none of these animals showed gross evidence of liver changes. Darkfield examination of the blood and serums of the controls Nos. 1 and 2, 21B and 21U revealed the presence of the filaments previously described. All other serum or blood darkfield examinations or both were negative. The gall-bladder bile and urinary bladder urine by darkfield examination were entirely negative for spirochetes or fibrils.

Liver, lung, spleen and kidney tissues were taken from the animals and were sectioned by the laboratory of the 64th General Hospital (Army). A brief summary of the findings is as follows:

No. 1 (control)

- Liver:* A lobular pattern is present throughout the section. The parenchymatous tissue is well preserved with nuclei and cytoplasm clearly outlined. Sinusoids are filled with blood.
- Lung:* Patchy areas of pneumonia.
- Spleen:* Malpighian corpuscles are well outlined and normal in number and size. The red pulp is devoid of blood.

No. 2C. *Liver:* Normal.

- Lung:* Patchy areas of pneumonia.

- Spleen:* Normal.
Kidney: Glomeruli are normal with afferent and efferent vessels filled with blood and Bowman's capsule easily seen. Ascending and descending loops of Henle and collecting tubules are normal.
- No. 3C. *Liver:* High-grade fatty degeneration. The lobular pattern is absent. No normal tissue is present except at the periphery of the section. Most of the cells of the liver cords appear to be vacuolated with both nuclei and cytoplasm absent.
Lung: Normal.
Spleen: Malpighian corpuscles are hypertrophied.
- No. 4C. *Liver:* Spotty type of fatty degeneration less marked in degree than in 3C.
Lung: Spotty type of pneumonia in resolution stage.
Spleen: Normal.
Kidney: Moderate amount of cloudy swelling of the parenchymatous tissue.
- No. 5C. *Liver:* Normal.
Lung: Normal.
Spleen: Normal.
Kidney: Normal.
- No. 6C. *Liver:* Normal.
Lung: Normal.
Spleen: Malpighian corpuscles are hypertrophied.
- No. 9U. (Injected with 5 cc. urine.)
Liver: Moderate degree of fatty degeneration of parenchymatous tissue.
Lung: Normal.
Spleen: Normal.
Kidney: Cloudy swelling of collecting tubules is present throughout the section.
- No. 13B. (Injected with 5 cc. blood.)
Liver: Possibly some early fatty degeneration but essentially a normal fatty liver of a young guinea pig.
Spleen: Normal.
Kidney: Normal.
- No. 16B. *Liver:* The lobular pattern is distorted but not obliterated. There is a patchy type of early fatty degeneration with both nuclei and cytoplasm absent.
Lung: Patchy areas of pneumonia.
Spleen: Normal.
Kidney: Normal.
- No. 17B. *Liver:* An essentially normal fatty liver of a young guinea pig.
Lung: Normal.
Spleen: Normal.

- No. 21U. *Liver:* Many mid-zonal and periportal areas of marked fatty degeneration. Normal tissue is present surrounding the areas.
Lung: Normal.
Spleen: Normal.
Kidney: Normal.
- No. 21B. *Liver:* Essentially a normal liver of a young pig.
Lung: Clearly circumscribed areas of pneumonia.
Spleen: Some hypertrophy of the corpuscles.
Kidney: Normal.
- No. 25B. *Liver:* Normal.
Lung: Normal.
Spleen: Normal.
- No. 27B. *Liver:* Marked fatty degeneration but with normal tissue present in periphery of the section.
Lung: Normal.
Spleen: Normal.
Kidney: Cloudy swelling of tubular epithelium.
- No. 28B. *Liver:* Normal.
Lung: Normal.
Spleen: Normal.

The interpretation of these findings is difficult, inasmuch as an unusually large amount of fat in the liver of young guinea pigs is normally present. Definite pathologic changes were noted in the livers of the normal control pigs as well as those of the injected animals. The only conclusion is that there may be experimental liver damage from the injection of both blood and urine of jaundiced patients in these pigs, but the present evidence must be considered inconclusive.

CAUSATIVE AGENT

Many theories as to the cause of this outbreak of jaundice were suggested, principally as follows:

1. The jaundice was associated in some way with the dysentery that was so prevalent during the past 6 months. Some medical officers said that men with dysentery complained of pain in the right upper quadrant of the abdomen and examination showed evidence of liver enlargement.

2. The toxic reaction from trinitrotoluene (TNT) or some other substance present in explosives has been suggested as one of the possible causes of this jaundice. Access by all personnel to this substance is possible, and the experimental production of liver damage by TNT has been demonstrated.

3. An atypical malaria might be the explanation for the jaundice.

4. A very prevalent theory in Army groups is the possibility of atabrin being responsible for jaundice. The basis for this theory is the high incidence of toxic reactions in men receiving this drug and the frequency of a yellow tinge to the skin.

5. Wine has been implicated by some medical officers. The ketones, aldehydes and other organic substances present in wine have been considered as the toxic agents.

6. Yellow fever vaccine or an associated virus present in the vaccine has been postulated by some as the cause of the present jaundice. The long latent period between the vaccine injection and onset of jaundice has been explained by suggesting that the virus was lying dormant and was incited to virulence by an intercurrent injection.

7. An atypical Weil's disease has been suggested by many workers and "leptospirae" have been reported by some.

8. A virus cause has seemed plausible to most investigators and the term "epidemic hepatitis" rather than "acute catarrhal jaundice" has been suggested as a more descriptive term for the disease.

Evidence for or against these theories is obtained as follows:

1. A history of diarrhea, presumably bacillary dysentery, was given by 72 percent of a group of 200 men selected at random at this station. Furthermore, 83.6 percent of the patients gave a history of previous diarrhea. Using standard statistical methods (chi square from a fourfold table) this ratio could occur by chance 8 times out of 100 and therefore it is not significant. In addition very few of the patients gave a history of pain in the upper right quadrant of the abdomen or had evidence of liver enlargement during the attack. As was mentioned previously, in only one patient was a shigella isolated from his stool. No constant time relationship between the previous diarrhea and the present jaundice was noticeable.

2. In experimental trinitrotoluene poisoning hemosiderosis and acute yellow atrophy were prominent pathologic findings. Liver sections from two Army fatalities from typical jaundice cases showed no evidence of hemosiderosis which probably would have been present in the case of TNT "poisoning."

3. The possibility of this jaundice being related to previous malaria or present "atypical" malaria is a very remote one. Only 5, or 6.9 percent, of the patients gave a history of previous malaria, whereas 7.3 percent of the controls had had malaria. Statistically this ratio would occur in 70 chances out of 100. Also as was mentioned previously all patients had negative blood thick smears on two examinations.

4. The atabrin theory would be more plausible in the group where all presumably are taking atabrin than in this group in which less than one-half of the men received atabrin. Only 46.4 percent of the control group and 45.6 percent of the patient group gave a history of previous use of atabrin. Statistically this ratio would occur in 75 chances out of 100. The relationship between jaundice and atabrin seems to be very tenuous.

5. Wine consumption by the patients was markedly less than that by the control group. Only 63 percent of the patients had any wine (and most of these are very light drinkers) while 85.5 percent of the control group were wine drinkers. There is statistically a *negative* relationship here as this would occur by chance in considerably less than one chance in 100. These figures tend to make the wine theory untenable.

6. The possibility of this jaundice being related to yellow fever vaccination of course must be considered. The facts that (a) the average time of injection for a control group of 200 men was in October 1942 and that for the patient group was in November 1942; (b) 42 different lots of vaccine were used on the 66 patients receiving vaccine and only 8 duplicate lots were used; and (c) 91.7 percent of the patients and 89.6 percent of the controls received the vaccine, a ratio that would occur by chance 70 times out of 100, all make this theory of etiology an unlikely one.

7. Evidence against the spirochetal theory has already been presented in the laboratory discussion. The important points that should be stressed are that (a) no true *Leptospira icterohemorrhagiae* has been demonstrated in darkfield preparations of either serum or urine of patients or injected animals; (b) no spirochete has been seen in stained preparations of urine, or serum; (c) the guinea pigs failed to show the clinical or pathologic findings ordinarily seen in Weil's disease; and (d) the patient's clinical course and prompt recovery are not suggestive of Weil's disease.

8. Probably the most tenable theory of etiology of the present jaundice is the "virus" one. Proof is entirely of a negative or comparative nature. Although it has not been possible to demonstrate a virus, many of its clinical and epidemiologic characteristics suggest a close relationship with such virus diseases as poliomyelitis and measles. The disease has a spotty distribution and a seasonal incidence quite similar to that of poliomyelitis. From its distribution at this station it might be inferred that there is a high incidence of subclinical cases, carriers, and immune individuals. Proof of this, however, is lacking.

HAZARDS OF CARBON TETRACHLORIDE IN PRESENT-DAY USE

SAMUEL R. SHERMAN

Lieutenant Commander (MC) U.S.N.R.
and

CLIFFORD F. BINDER

Lieutenant Commander (MC) U.S.N.R.

Carbon tetrachloride, discovered by Regnault in 1839, is non-inflammable, nonexplosive, relatively inexpensive, and is one of the most useful of industrial organic solvents. Its production was tripled during the decade from 1930 to 1940, and war conditions have still further increased its scope of usefulness (1). Hence it is more important than ever to evaluate correctly the health hazards presented by this solvent.

This chlorinated solvent is used as a degreaser for metal parts, as a cleaning agent in dry cleaning, in the extraction of fats, as a solvent for crude rubber, tar, and resins, in the vulcanization of rubber, in fire extinguishers, as a component of insecticide sprays and soap solutions, as a delousing agent, as a dry hair shampoo, and as an anthelmintic, being almost specific against hookworm. As a fire extinguisher, it is sold under the trade name "Pyrene" and as a dry cleaning agent is sold under many trade names, one of which is "Carbona." "Chlorasol" is a mixture of 25 percent carbon tetrachloride and 75 percent ethylene dichloride and is used as a fumigant. Some other trade names are "Asordin," "Benzinoform," "Phoenipine," "Spectral," "Tetra," "Tetracol," "Tetraform," and "Katarine" (2).

Carbon tetrachloride or tetrachlormethane (CCl_4) is a clear, colorless, mobile liquid having a characteristic ethereal odor resembling chloroform. It boils at between 76° and 78° C., has a density of from 1.588 to 1.590 at 25° C., and is an excellent solvent for fats, tars, most fixed and volatile oils, and many organic compounds. It is soluble in about two thousand times its volume of water and is miscible with alcohol, chloroform, ether, benzine, and petroleum benzine. It is noninflammable. It is slowly decomposed by light, and by various metals if moisture is present.

Carbon tetrachloride is made by passing dry chlorine into carbon disulfide containing a small quantity of iodine in solution:



The carbon tetrachloride is first distilled off at 77° C., and the

sulfur monochloride (boiling point 136° C.) is rectified for industrial use (3).

TOXICOLOGY

A number of cases of industrial poisoning from the inhalation of vapors of carbon tetrachloride have been reported. The symptoms caused by carbon tetrachloride poisoning are irritation of the nose, eyes and throat, headache, nausea, vomiting, abdominal pain, diarrhea, stupor deepening into coma, convulsions, weak pulse, fever, and uremia culminating in death (4). It is about twice as toxic as chloroform, which is about 100 times as toxic as ethyl alcohol (5) (6). Its narcotic effects are less marked but its effect on the liver, heart and kidneys is much more rapid.

Poisoning by chlorinated solvents may occur from inhaling their vapors, from long or repeated contact of these liquids with the skin, or from swallowing them. As many of these solvents evaporate rapidly they get into the air very easily. The vapors cause irritation of the eyes, nose, throat and lungs. These liquids also remove the natural oil from the skin and thus may cause local damage. When these substances are absorbed into the body they cause damage to the liver and other vital organs. This damage depends upon the amount absorbed, and the signs and symptoms of internal poisoning are often delayed. Chronic poisoning results from long continued exposure to small amounts of chlorinated solvent. Acute poisoning occurs from breathing large amounts of the vapors for a short time.

Under ordinary conditions, when carbon tetrachloride is used to extinguish fires in relatively open spaces, the concentrations of phosgene and hydrochloric acid produced are irritating but not very harmful, but in a small cell or room, especially where there is no simple exit, there is danger of sufficiently high concentrations being harmful. The decomposition products of carbon tetrachloride have adequate lacrimatory warning properties.

Persons known to be regular consumers of alcoholic beverages in substantial or excessive quantities, or persons who are excessively obese, should not be employed about chlorinated solvent systems, or be exposed to vapors of chlorinated solvents even in amounts known to be nonhazardous to normal individuals (7). It has been definitely established that carbon tetrachloride is a dangerous substance for alcoholics and for persons with a low calcium balance, and that its absorption is greatly hastened by the presence of either alcohol or fats in the intestines.

Carbon tetrachloride is an industrial hazard if vapor is permitted to escape into the open room and its concentration is con-

stantly above 0.01 percent (8). With carbon tetrachloride, according to Flury (9), 5,000 parts per million endanger life within 30 minutes, and 50,000 parts per million will cause fatalities in 5 to 10 minutes. Henderson and Haggard (10) consider a concentration of 48,000 to 63,000 as dangerous to life with "brief" exposure.

Exposures to carbon tetrachloride vapor concentrations sufficient to cause narcosis do not necessarily result in secondary poisoning.

CLINICAL AND PATHOLOGIC MANIFESTATIONS

In varying degrees, its various constituents act as narcotic poisons and are capable of causing severe damage to liver and kidneys. Smith (11) states that carbon tetrachloride belongs to a group of chemicals which is conspicuous for its ability to damage the liver, and because in some experimental work the most striking lesions have been found in the liver, there is a tendency to overlook the fact that this chemical may show its principal and sometimes sole effect upon the kidneys.

Smetana (12) defines the typical clinical picture as characterized by headache, dizziness, general malaise, fever, sometimes irritation of nasal and conjunctival mucous membranes, signs of gastric irritation with nausea, vomiting, diarrhea, and sometimes hematemesis, followed in several days by signs of renal involvement, that is, oliguria progressing to uremia, convulsions, hypertension, edema, and sometimes uremic coma. Jaundice may be present. Cyanosis and pulmonary edema may develop.

In a susceptible individual, a fatal renal process may follow only moderate exposure to carbon tetrachloride, and the hepatic disease may not be of sufficient severity to produce recognizable clinical symptoms.

Perry (13) reported a series of cases in which 88 soldiers were exposed to the toxic fumes of carbon tetrachloride in the course of cleaning their newly issued service rifles in the downstairs barracks back room. The room was small, hot and poorly ventilated. Concentration of the gas was sufficient to cause coughing in all personnel exposed. All exhibited symptoms of headache, anoxemia, malaise, vomiting, dizziness, and even stupor, and there were two fatalities caused by liver and kidney damage. Those of the soldiers who were heavy drinkers manifested symptoms more severe in character.

Three cases of carbon tetrachloride poisoning, with two deaths were reported from a ship where a number of men had apparently been as directly exposed to carbon tetrachloride fumes as were the three men hospitalized, but no other toxic symptoms were reported.

Autopsy showed diffuse fatty degenerative liver changes in both patients, and both showed acute toxic renal damage (hepatorenal syndrome). In the two fatal cases carbon tetrachloride exposure had been preceded by a week-end of overindulgence in alcohol.

The cause of illness in 135 employees in a Kentucky plant manufacturing parachutes was traced to carbon tetrachloride used for cleaning soiled spots on the chutes. The outbreak of illness occurred over a period of 10 days, and was manifested by abdominal cramping, nausea, and vomiting. Some individuals complained of "bloating and difficulty in breathing." Many employees were acutely ill and unable to continue work. The illness lasted from 2 to 5 days in the average case, although a number of workers continued to feel badly after resuming work.

Sanford (14) reports a case of sudden death from the industrial use of carbon tetrachloride. A young seaman apparently in vigorous health ate a normal supper, took a shower bath, and was seen by others in the barracks to stagger toward his bunk. He collapsed and in spite of artificial respiration and all restorative measures was dead in a few minutes. A complete autopsy was performed. Some congestion of the lung bases was found and there were petechial hemorrhages over the epicardium. The brain stem was markedly congested, but there was no extravasation of blood. Microscopic examination of the tissues yielded no additional significant facts.

An hour-to-hour investigation of the man's activities during the day revealed that he had been working on and cleaning engine parts. His hands and forearms had become covered with grime, and at about 1630 he used a whole bottle of carbon tetrachloride to remove the oil and dirt from his hands and forearms, and also cleaned his shoes with the fluid. A thorough investigation revealed no other clue to his sudden death.

CASE REPORTS

Case 1.—This patient, 30 years old, stated that he had been well until 1 week previously when he took it upon himself to clean a bombsight, using about 1½ gallons of carbon tetrachloride solution for the purpose, placing the solution and the bombsight in a large open sink. His sleeves were rolled to the elbows and he immersed both arms for about 20 minutes. He said the air-conditioning fan was not working in the room at that time and that the windows were not open, so that ventilation was very poor. He claims to have been overcome by the fumes two or three times, and although he was very "giddy" he did not "pass out."

Later that evening, and on the next day, he noticed a great deal of coughing and throat irritation but did not attach much significance to these symptoms. However, on the following day he noticed that both of his eyes were

markedly "bloodshot," so he consulted the eye doctor for this condition but did not tell him about his exposure to the carbon tetrachloride. On the following day he felt nauseated and vomited and noticed a slight yellowish tinge to his skin and his eyeballs. This condition persisted without treatment until he applied for admission to the sickbay. The patient admitted that he had been a heavy drinker for the past two years but denied ever having consumed bombsight alcohol or wood alcohol.

The patient was completely rational and did not appear to be exceptionally ill at the time of admission. There was a slight icteric tint to the entire skin and sclera, petechial hemorrhages of the skin of the chest and extremities, and ecchymotic regions on the skin of both thighs were found. There were a few coarse râles throughout both lung fields. The abdomen was somewhat obese and slightly distended. The liver edge was palpable four fingers' breadth below the right costal margin and there was marked tenderness upon palpation.

The hemoglobin content was 100 percent, erythrocyte count 4,310,000 and leukocytes 16,200 with a differential count of 6 band forms, 75 segmented cells, 16 lymphocytes and 1 monocyte. The icterus index was 15 units. The urine was dark, bile-stained, and negative for albumin, glucose and casts.

On the day of admission the patient vomited almost continually and was given 1,000 cc. of 5-percent dextrose in saline intravenously, very slowly, with some relief of his vomiting. About 4 hours later he began to cough up frank blood and had a severe attack of epistaxis. Physical examination of his chest revealed an acute pulmonary congestion of both lung fields, plus an increase in pulse rate and the patient's condition rapidly grew worse until he became so dyspneic that he was immediately placed in an oxygen tent. During this time he manifested a remarkable amount of "air hunger." He was given emergency treatment consisting of rapid digitalization with cedilanid, 4 cc. intravenously, which was repeated in 12 hours, and was also given 50 cc. of 50-percent dextrose solution intravenously and 2 cc. of salyrgan-theophylline intravenously. Morphine was given in $\frac{1}{4}$ -grain doses for extreme restlessness and was supplemented by coramine and atropine for the pulmonary condition.

On the second hospital day the patient grew rapidly worse. The temperature rose to 102° F., the pulse rate to 120, and respirations to 40. The lung fields were markedly more congested and the respirations were of the Cheyne-Stokes type. The patient was conscious and rational, and showed no neurologic abnormalities. Hemoptysis was still present. A vitamin K preparation in 1-cc. doses was given intravenously twice at 4-hour intervals. The coramine, atropine and the oxygen tent were continued, but the patient's course was steadily downhill, and he expired at 2055.

The autopsy findings were those of acute terminal pulmonary congestion, acute gastritis, generalized icterus and marked congestion of the thoracic organs with no congestion in the abdominal organs. The kidneys were pale and swollen. There was bilateral hydrothorax, hydropericardium, and hydroperitoneum. There was a nutmeg liver. Petechial hemorrhages were seen in the lungs, heart and brain. Marked congestion and edema of all subcutaneous fat was present. There were bilateral conjunctival hemorrhages and a marked edema of the brain, with an area of softening in the frontal lobe.

The autopsy findings, together with the history of excessive exposure to carbon tetrachloride fumes, confirmed the admission diagnosis of a toxic hepatitis. It demonstrates the toxicity of carbon

tetrachloride on an individual who is obese and a chronic alcoholic. Sanford (14) made the statement that "after several days or weeks, recovery is the rule." It was disproved in this case. This was not a case of phosgene poisoning.

Case 2.—This man reported to the sickbay complaining of a "groggy" feeling from a hangover. He had indulged excessively in alcohol on the previous evening, and was reclining in a small room in the ordnance building while a shipmate was cleaning a gun with carbon tetrachloride. The patient was certain that the ventilation was adequate and that the other man noticed no ill effects, but claims that he became weak and dizzy and noticed an irritation of his nose, throat, and lungs, and coughed a great deal. He felt better when he went out into the fresh air but remained nauseated for the entire day and began vomiting later that evening. The vomiting continued for another 48 hours and was accompanied by some diarrhea and headache.

Upon examination the patient appeared to be dehydrated and had a slight icteric tint to the skin and sclera. There was moderate tenderness in the upper right quadrant of the abdomen and the liver edge was palpable about 5 cm. below the right costal margin.

The urinalysis showed a faint trace of albumin. Complete blood count was normal. Icterus index was 21 units, and blood calcium 13.3 mg.

Treatment consisted of the intravenous administration of 1,000 cc. of 5-percent dextrose in normal saline with 10 cc. of 10-percent calcium gluconate daily; calcium lactate 20 grains 4 times daily; high carbohydrate, low fat diet; prochloron 5 grains 3 times daily. The temperature, pulse and respirations remained normal, the icterus diminished, the chest remained entirely clear, and the patient was greatly improved 7 days after admission and was discharged to light duty under treatment.

This case emphasized the toxicity of carbon tetrachloride in an individual who had previously used alcohol in excess. A normal blood calcium, promptness in reporting the condition, and immediate treatment give a much more favorable prognosis.

Case 3.—This patient, 21 years old, stated that on the previous day while in a small building which was not too well ventilated, he was cleaning a carburetor starter and was using about 3 gallons of carbon tetrachloride as a solvent. He was slightly overcome by the fumes and experienced some irritation of the nose and throat. That night he noticed nausea, vomiting, and some abdominal pain, and suffered from a severe headache all the next day. This was accompanied by a moderate amount of diarrhea, and he reported about noon time for medical treatment. He denied recent use of alcohol.

This patient was slender and well nourished. He appeared quite ill and had a moderate amount of icterus of his skin. The eyes also showed some icteric tint. The liver was somewhat tender and slightly enlarged. The spleen was not palpable. Results of physical examination were otherwise negative.

The hemoglobin content was 90 percent, erythrocyte count 4,170,000, leukocyte count 9,800 with a differential count of 74 segmented cells, 25 lymphocytes, and 1 eosinophil. The urinalysis revealed a specific gravity of 1.030, was clear, acid, negative for sugar and albumin and showed 1-plus mucus and 1 to 3 leukocytes in a high dry field. The blood urea was 13 mg. percent.

Treatment consisted of 1,000 cc. of 5-percent dextrose in normal saline with 15 grains calcium gluconate given intravenously twice daily for 2 days; cal-

cium lactate 20 grains every 4 hours and high carbohydrate, fat-free diet.

Nausea, vomiting and diarrhea subsided on the first day but the icterus increased, the patient however felt much better. On the third hospital day he was entirely well except for a slight remaining icterus and was discharged to light duty under calcium lactate therapy with precautions regarding further exposure to carbon tetrachloride.

Case 4.—This patient stated that he was cleaning a machine gun in the ordnance room of a hangar using about one quart of carbon tetrachloride at a time. The windows were closed and the ventilation was poor. In about 40 minutes he became weak and dizzy and was extremely nauseated and vomited several times. No coughing or nasal irritation was present, but several hours later diarrhea developed and continued for over 24 hours. The patient stated he had been in excellent health lately although somewhat overweight, and denied excessive alcoholic indulgence except for 6 bottles of beer consumed on the day previous to exposure.

The patient was moderately jaundiced and had a definite icterus of the scleras. Physical findings were otherwise normal except for slight tenderness of the liver and slight upper left abdominal tenderness. There were no palpable masses.

Urinalysis showed 2-plus albumin and 2 or 3 pus cells. The icterus index was 18 units.

Treatment consisted of 1,000 cc. of 5-percent dextrose in normal saline solution with 15 grains calcium gluconate intravenously; calcium lactate 20 grains 4 times daily; high carbohydrate, fat-free diet and thiamine chloride 25 mg. subcutaneously daily. Four days after exposure the patient was entirely well and was discharged to light duty.

Cases 3 and 4 illustrate the toxicity of carbon tetrachloride when used in an improperly ventilated space and the susceptibility of certain individuals. Prompt treatment in each case resulted in uneventful recovery.

TREATMENT

In acute cases of carbon tetrachloride poisoning, prompt recognition of the condition, together with immediate institution of adequate therapy is essential for favorable outcome. It is recommended that in early cases the excessive unabsorbed carbon tetrachloride be removed from the gastro-intestinal tract by means of stomach lavage and colonic irrigation. The forcing of fluids by mouth and by the parenteral route is also indicated, and use of 5-percent to 10-percent dextrose in water or saline up to 1,000 cc. intravenously is especially recommended. As further protection against liver damage, 50 cc. of 50-percent dextrose may be administered intravenously at least twice daily for the first two or three days in the more severe cases. Calcium gluconate in 10-percent solution intravenously every 12 hours for the first two days supplemented by 20 grains of calcium lactate orally four or five times a day, further tends to increase the liver's ability to offset the toxic effects of carbon tetrachloride. When a great deal of liver damage

is already present, liver concentrate or liver extract should be given intravenously, and can be fortified by the addition of thiamine chloride and synthetic vitamin K. The latter is especially valuable if excessive bleeding is present in the form of hemoptysis, hematemesis, epistaxis, or mucous membrane hemorrhages.

The usual dietary precautions for liver damage such as the high carbohydrate, fat-free diet should be observed carefully. When the patient has nausea and diarrhea, liquids fortified by the addition of sugars are best tolerated. Symptomatic treatment for diarrhea, vomiting, and irritation of the respiratory tract may be instituted if indicated. Likewise, the administration of oxygen by means of the intranasal catheter, a mask or a tent should be considered for the cases in which acute pulmonary congestion is the predominant manifestation. Restoration of cardiac compensation with either digitalis or cedilanid is also important for this condition in order to offset further myocardial damage.

Whole blood and plasma transfusions should be given to combat the effects of shock and toxicity which are not uncommon in those patients who have received an overwhelming amount of the poison. Withdrawing 500 to 800 cc. of the patient's blood and replacing it with a like amount of fresh whole blood is also a markedly beneficial procedure in the more toxic cases.

It should not be forgotten that the laboratory can render important aid to the clinician in determining both the diagnosis and prognosis of this clinical entity. The blood chemistry determinations should be repeated until the blood returns to normal.

Another precaution concerning the early treatment of carbon tetrachloride poisoning should be constantly borne in mind. Medical officers on board ships and at industrial shore stations must always be on the alert for this diagnosis when confronted with cases of nausea, vomiting and diarrhea at sick call. A few pertinent questions regarding the type of work in which the patient has been engaged may easily bring to light the often-missed diagnosis of this poisoning.

PREVENTION

The hazards of carbon tetrachloride can be removed by proper ventilation, and by keeping such substances in containers where they do not permeate the air. Frequent examination of the workers, rotating their jobs or removing them from contact with the fumes will help prevent the development of serious conditions. Supervised selection of individuals to work with this substance will greatly eliminate the hazard. Non-obese, non-drinkers are particularly desirable.

Chlorinated hydrocarbons are habit-forming narcotic agents. As soon as there is any indication that an operator is developing a craving for exposure to these materials he should be transferred to another type of work and referred for a careful medical examination.

It is extremely important that solvents of the carbon tetrachloride type be used only in well ventilated places, and that the skin of the men handling them be protected from the solvent or that skin exposure be kept to a minimum. If carbon tetrachloride is used for degreasing, this should be carried out by the use of long-handled brushes, wire baskets, slushing the parts to be degreased, or by closed degreasing machines designed for that purpose.

SUMMARY

To summarize briefly, it is pointed out that the introduction of small quantities of chlorinated hydrocarbons into the human body may set up insidious reactions in the organs that may result in permanent injury. It is therefore suggested that every precaution possible be taken to safeguard the health of workmen engaged in the operation of systems in which chlorinated solvents are employed.

Attention is called to the fact that carbon tetrachloride poisoning may occur much more commonly than is ordinarily anticipated, and that Naval medical officers both ashore and afloat should bear in mind the possibility of this condition at all times. Early recognition and judicious treatment will offer a much more favorable prognosis.

Pathologic manifestations of carbon tetrachloride poisoning are not only those of toxic hepatitis, as is well known, but also occur as the hepatorenal syndrome, pulmonary hemorrhages and congestion, multiple petechial hemorrhages, and cerebral edema with focal necrosis.

REFERENCES

1. EASTON, W. H.: Carbon tetrachloride in industrial hygiene. *Indust. Med.* 12: 1-3, January 1943.
2. SAPPINGTON, C. O.: *Medicolegal Phases of Occupational Disease: An Outline of Theory and Practice*. Indust. Health Book Co., Chicago, 1939.
3. ROGERS, C. H.: *A Text-book of Inorganic Pharmaceutical Chemistry*. Lea & Febiger, Philadelphia, 1936. p. 485.
4. JACOBS, M. B.: *The Analytical Chemistry of Industrial Poisons, Hazards and Solvents*. Interscience Publishers, Inc., New York, 1941. Vol. 1, p. 442.
5. WALLER, A. D.: The relative toxicity of chloroform (CHCl_3) and of carbon tetrachloride (CCl_4). *Lancet* 2: 369-370, 1909.

6. MCCONNEL, W. J.: Volatile solvents as a problem in industrial medicine. J.A.M.A. 109: 762-768, September 4, 1937.
7. TOWERS, J. H.: Technical Order No. 52-40. Chlorinated Solvents—Operating Instructions. Navy Department, Bureau of Aeronautics, Washington, D. C., November 19, 1940.
8. DAVIS, P. A.: Carbon tetrachloride as industrial hazard. J.A.M.A. 103: 962-966, September 29, 1934.
9. FLURY, F.: Moderne gewerbliche Vergiftungen in pharmakologisch-toxikologischer Hinsicht. Arch. f. exper. Path. u. Pharmacol. 138: 65-82, 1928.
10. HENDERSON, Y., and HAGGARD, H. W.: Noxious Gases and the Principles of Respiration Influencing Their Action. Monograph series No. 35. Chem. Catalogue Co., New York, 1927. p. 160.
11. SMITH, A. R.: Acute nephritis from exposure to carbon tetrachloride. Indust. Hyg. Bull. 22: 171-172, April 1943.
12. SMETANA, H.: Nephrosis due to carbon tetrachloride. Arch. Int. Med. 63: 760-777, April 1939.
13. PERRY, W. J.: Carbon tetrachloride poisoning—report of 88 cases. Army M. Bull. 64: 70-74, October 1942.
14. SANFORD, S. P.: Carbon tetrachloride poisoning. U. S. Nav. M. Bull. 41: 1486-1488, September 1943.



CAUSES (?) OF NONSPECIFIC ULCERATIVE COLITIS

As the various terms nonspecific, idiopathic, primary, suppurative, and indeterminate ulcerative colitis imply, the etiologic agent is unknown. Organisms have been described, but their etiologic role has not been established. Barga attributed the condition to a gram-positive diplococcus and developed a serum for its control. The results, on the whole, have been disappointing. Avitaminosis is thought to be a contributing factor and ulceration of the colon in lower animals has been produced by vitamin deficiencies. Constitution and heredity are undoubtedly important.—DANIELS, G. E.: Nonspecific ulcerative colitis as psychosomatic disease; definition, clinical and pathological picture. M. Clin. North America 28: 593-602, May 1944.

A CAMPAIGN AGAINST "ATHLETE'S FOOT"

JACK L. DERZAVIS
Lieutenant (MC) U.S.N.R.

and
JOHN R. POPPEN
Captain (MC) U.S.N.

During the period from April to December of last year 13,341 patient-visits were made to the dermatology and chiropody departments of the Naval Air Station, Corpus Christi, Texas, for the treatment of "athlete's foot" (dermatophytosis). Each visit represents a minimum time loss of 1 hour per man. This enormous time waste is in addition to the many days lost as a result of hospitalization for the more severe forms of the disease and their morbid and discomfoting complications.

Although these fungus infections are generally universally distributed, hot, humid climates are conducive to the development of infections which thrive and respond slowly to treatment.

To prepare for the hot, humid season, and to prevent a minor disease from becoming a major catastrophe, an educational program was undertaken. It included the distribution of informative literature, cartoon posters, and short messages and cartoons printed in the Center's weekly news publication.

The instructions given are of the simplest nature, easy to follow and entail the expenditure of a minimum of time, effort, and expense. They are as follows:

1. WASH YOUR FEET DAILY AND DRY THEM THOROUGHLY.
2. ALWAYS KEEP THE FEET, ESPECIALLY THE INNER SIDES OF THE TOES, WELL POWDERED WITH A FINE, NOT HIGHLY PERFUMED, TALCUM POWDER OR FOOT POWDER. THIS IS ESPECIALLY IMPORTANT AFTER BATHING.
3. OBTAIN SHOES THAT FIT PROPERLY.
4. IF SHOES AND HOSE BECOME WET, CHANGE INTO DRY ONES AS SOON AS POSSIBLE.
5. REPORT TO THE MEDICAL DEPARTMENT AT THE FIRST SIGN OF ITCHING, CRACKING, OR BLISTER FORMATION ON THE TOES OR FEET—NO MATTER HOW TRIVIAL IT MAY SEEM.

In each of the newspaper notices these directions are preceded by several short paragraphs of an exhortative nature, such as:

"Athlete's foot" (Fungus infection of the foot) is generally a minor annoyance. However, a moist, hot climate such as experienced in this area, and the added maceration of the skin of the feet caused by marching and general Navy duty, often result in a severe, crippling form of this disease.



ATHLETE'S FOOT CAN BE PREVENTED BY PROPER CARE OF THE FEET. INQUIRE AT THE MEDICAL DEP'T.

ATHLETE'S FOOT *can be just as bad as a* **BROKEN LEG!**



SAVE MAN-DAYS BY REPORTING TO THE MEDICAL DEP'T AT THE FIRST SIGN OR SYMPTOM



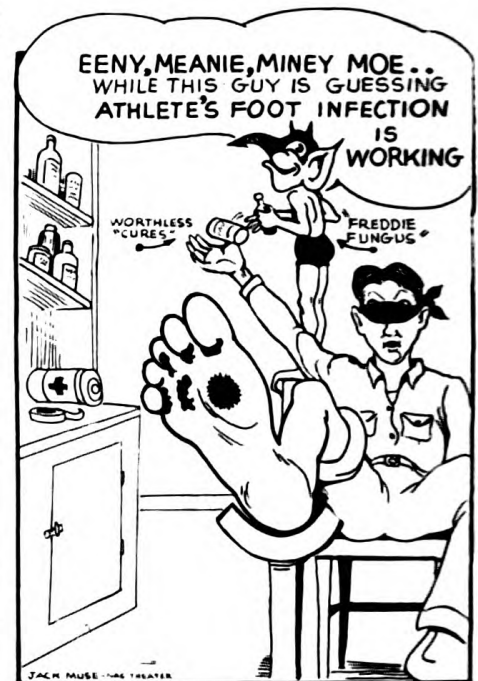
TREAT ATHLETE'S FOOT EARLY AT THE FIRST SIGN—REPORT TO THE MEDICAL DEP'T.



DON'T WAIT UNTIL YOU ARE A CRIPPLE.—REPORT FOR TREATMENT EARLY.



TIME LOST BECAUSE OF ANY DISEASE IS A LOSS TO THE WAR EFFORT. DON'T LET A MINOR DISEASE (ATHLETE'S FOOT) CAUSE A MAJOR DISASTER.



SELF TREATMENT IS DANGEROUS - REPORT TO THE MEDICAL DEP'T.

These serious cases of "athlete's foot" can be prevented by proper early treatment at the first sign of irritation of the feet if patients so affected report to the Medical Department at once. In addition, by proper and diligent care of the feet most cases of athlete's foot can be prevented. The following simple methods of foot care are advised by the Medical Department:

Loss of time due to war wounds is excusable, but time lost as the result of preventable "athlete's foot" is without excuse. If you neglect your feet you may lose time just as though you were wounded in battle. Don't wait until you need a crutch. Follow this simple advice:

You wouldn't intentionally put your foot into a meat grinder. It's a horrible thought, isn't it? Severe "athlete's foot" can be almost as bad, so at the first sign of foot trouble report to your Medical Department and prevent a serious disease. Follow these directions on foot care:

Do not help one of our most insidious saboteurs, the fungus that causes "athlete's foot" and loss of time. "He" needs warmth and moisture to grow, so keep your feet dry and powdered at all times.

Follow these simple directions and increase your efficiency in the war effort:

The posters used in the campaign are original and were drawn by a member of the station personnel. Copies may be obtained from the Naval Air Training Center, Corpus Christi, Texas, on request.

NOTES ON OUR RESERVE CONTRIBUTORS

Anderson, Truman O., Lieutenant Commander (MC) USNR (*Quick-Filling Irrigating Syringe*, p. 563). M.D., Hahnemann Medical College, 1918. Intern: Hahnemann Medical College Hospital, May 1917–May 1918; Eye, Ear, Nose and Throat Service, U. S. Naval Hospital, Great Lakes, June 1918–Jan. 1919; Nose and Throat Clinic, Hahnemann Medical College Hospital, June 1919–Aug. 1921; Illinois Charitable Eye and Ear Infirmary, 1921–22; Illinois Post Graduate Hospital, 1922–23; eye surgeon for: Chicago Bridge and Iron Works; Sherwin Williams Co.; Van Etten Bros. Contractors; Great Lakes Forge Co., Chicago; private practice, Chicago, 1919–; staff member, Roseland Community Hospital, Chicago. Member: Chicago Medical Society; Illinois State Medical Society; American Medical Association.

Baldree, Charles E., Jr., Lieutenant Commander (MC) USNR (*Debridement Unit*, p. 555). M.D., University of Tennessee College of Medicine. Intern, St. Louis City Hospital No. 1, July 1928–July 1929; resident surgeon, Frisco Employes' Hospital, St. Louis, Mo., July 1929–July 1930; assistant chief of surgery, George C. Hixon Memorial Hospital, Electric Mills, Mississippi, January 1931–July 1933; private surgical practice, July 1933–42; staff surgeon: St. Elizabeth's Hospital, Bellville, Ill.; St. Clair County Hospital and Home, Bellville; visiting surgeon: St. Mary's Hospital, East St. Louis, Ill.; Christian Welfare Hospital, East St. Louis; instructor in surgery, St. Louis University School of Medicine; attending surgeon: St. Luke's Hospital; Evangelical Deaconess Hospital; Missouri Baptist Hospital, St. Louis. Fellow: American College of Surgeons; American Medical Association; member; St. Louis Medical Society; St. Clair County Medical Society; Illinois State Medical Association.

Benkwith, Karl B., Lieutenant (MC) USNR (*Early Ophthalmic Findings in a Case of Spontaneous Subarachnoid Hemorrhage of Brain*, p. 535). A.B., University of Rochester; M.D., University of Rochester School of Medicine and Dentistry, 1934; M.S. in Ophthalmology, University of Minnesota Medical School, 1940. Intern, 1935, and resident in pathology, 1936, University of Oregon Medical School Hospitals and Clinics; fellowship in ophthalmology, University of Minnesota Medical School, 1937–40; ophthalmologist, St. Margaret's Hospital, Montgomery, Alabama, 1940–42. Fellow Academy of Ophthalmology and Otolaryngology. Diplomate American Board of Ophthalmology.

Berger, Edmund H., Commander (MC) USNR (*Gastric Diseases in Navy Personnel*, p. 450). M.D., University of Oregon Medical School, 1929; M.S. in Medicine, University of Minnesota Medical School, 1933. Intern, Multnomah Hospital, Portland, Ore.; fellow in medicine, Mayo Foundation, Rochester, Minn., 1930–33; private practice, Portland, Ore., 1934–42; instructor in medicine, University of Oregon Medical School, 1934–42. Fellow: American College of Physicians; American Medical Association; Portland Academy of Medicine. Diplomate: National Board of Medical Examiners; American Board of Internal Medicine.

- Binder, Clifford F.**, Lieutenant Commander (MC) USNR (*Hazards of Carbon Tetrachloride in Present-Day Use*, p. 590). A.B., Yankton College, 1935; M.D., Creighton University School of Medicine, 1940. Intern, Creighton Memorial St. Joseph's Hospital, Omaha, Nebr., 1940-41.
- Bonsole, Harold Y. D.**, Lieutenant (DC) USNR (*A Time-Saving Combination Sling*, p. 557). D.D.S., School of Dentistry, University of Pennsylvania, 1932. Dental staff, New York Polyclinic Hospital, New York City, 1933-34; private practice, 1932-. Member: American Dental Association; First District Dental Society, State of New York.
- Cameron, Markley C.**, Commander (MC) USNR (*Emergency Surgical Spotlight*, p. 562). A.B., University of Pennsylvania, 1924; M.D., University of Pennsylvania School of Medicine, 1927. Intern, Western Pennsylvania Hospital, Pittsburgh, 1927-28; fellow in surgery, Mayo Foundation, Rochester, Minn., 1929-32; associate clinical professor of surgery, College of Medical Evangelists, 1934-; surgeon and gynecologist, Santa Rita Clinic, 1934-; staff member: St. Vincent's Hospital; Queen of Angels Hospital, Los Angeles; private practice, Los Angeles, Calif., 1933-. Fellow: American College of Surgeons; American Medical Association; member: California Medical Association; Los Angeles County Medical Association.
- Carleton, William T.**, Lieutenant Commander (MC) USNR (*Effective Management of Gastro-Intestinal Department at Naval Hospitals*, p. 459). A.B., Williams College, 1935; M.D., Harvard Medical School, 1939. Worcester City Hospital, 1939-41. Diplomate National Board of Medical Examiners.
- Derzavis, Jack L.**, Lieutenant (MC) USNR (*A Campaign Against "Athlete's Foot,"* p. 600). B.A., George Washington University, 1937; M.D., Georgetown University School of Medicine, 1937. Intern, Sinai Hospital, Baltimore, 1937-38; Graduate Medical School, University of Pennsylvania, 1938-39; provisional clinic assistant, Skin and Cancer Unit, Postgraduate Medical School of Columbia University, 1939-40; private practice, dermatology and syphilology, Washington, D. C., 1940-42; staff physician, Venereal Disease Division, Health Department, District of Columbia, 1941-42; instructor in dermatology and syphilology, Georgetown University School of Medicine, 1941-42. Fellow American Medical Association; member: American Academy of Dermatology and Syphilology; Baltimore-Washington Dermatological Association; American Public Health Association; Texas Public Health Association; Medical Society of the District of Columbia. Diplomate American Board of Dermatology and Syphilology.
- Ebeling, Walter W.**, Lieutenant Commander (MC) USNR (*Skeletal Traction in Fractures of Hand and Wrist*, p. 477). B.S., University of Washington, 1923; M.D., University of Pennsylvania School of Medicine, 1928. Intern, Hospital of the University of Pennsylvania, 1929-30; Hunter Fellow in Surgery, University of Pennsylvania School of Medicine, 1931-33; assistant instructor in surgery, University of Pennsylvania School of Medicine, 1932-33; private practice, Mount Vernon, Washington, 1935-. Fellow: American College of Surgeons; American Medical Association; member: Washington State Medical Association; Puget Sound Surgical Society.
- Engel, Milton B.**, Lieutenant (DC) USNR (*Thermal Stimuli in Operative Dentistry*, p. 502). D.D.S., 1938, and M.S., 1940, University of Illinois College of Dentistry. Carnegie Fellow, 1940-41, and staff member, 1941-42, Department of Orthodontia, University of Illinois; private practice, Chi-

cago, 1938-42. Member: American Dental Association; American Association for the Advancement of Science.

Filberbaum, Milton B., Lieutenant Commander (MC) USNR (*Waterhouse-Friderichsen Syndrome*, p. 549). A.B., Columbia University, 1923; M.D., Columbia University College of Physicians and Surgeons, 1928. Assistant in medicine, Long Island College of Medicine; assistant visiting physician, Kings County Hospital, Brooklyn; assistant cardiologist, out-patient department, Long Island College Hospital, Brooklyn. Fellow: American College of Physicians; American Medical Association; member: Kings County Medical Society; American Heart Association. Diplomate American Board of Internal Medicine.

Gezon, Horace M., Lieutenant (MC) USNR (*Investigation of a Jaundice Epidemic in Tunisia*, p. 579). A.B., Calvin College, 1937; M.D., School of Medicine, University of Chicago, 1940. Intern, 1940-41, and assistant resident, 1941-42, Bobs Roberts Memorial Hospital for Children (University of Chicago Clinics), Chicago.

Glauser, Frank, Lieutenant Commander (MC) USNR (*Management of Fungus Infection of the Feet*, p. 525). M.D., University of Pennsylvania School of Medicine, 1923. Intern, 1923-24; assistant, surgical service, 1924-38; and associate oncologic surgeon, 1940-, Jewish Hospital, Philadelphia; surgeon, courtesy staff, St. Luke's and Children's Medical Center, Philadelphia, 1942-; assistant surgeon, Northern Liberties Hospital, Philadelphia, 1931-43; clinical assistant, Temple University School of Medicine, 1929-; private surgical practice, Philadelphia. Fellow American Medical Association; member: Medical Society of the State of Pennsylvania; Philadelphia County Medical Society.

Gouze, Frank J., Lieutenant Commander (MC) USNR (*Air Embolism in a Diver*, p. 538). B.S., St. Edward's University, Austin, Texas, 1936; M.D., University of Minnesota Medical School, 1940. Intern, St. Mary's Hospital, Duluth, 1940-41; fellow, internal medicine, Minneapolis General Hospital, Minneapolis, Minn., 1941-. Fellow American Medical Association.

Greene, Oscar, Lieutenant Commander (MC) USNR (*Sodium Fluoride Poisoning*, p. 551). B.S., College of the City of New York, 1935; M.D., New York University College of Medicine, 1940. Intern, Fordham Hospital, New York City, 1940.

Hall, Henry H., Lieutenant Commander (DC) USNR (*Dental Chair as Auxiliary Operating Table*, p. 565). D.D.S., University of Maryland, 1933. Intern, 1933-34, and member dental staff, 1935-40, Baltimore City Hospitals; private practice, Baltimore, Md., 1934-40. Member American Dental Association.

Harner, Clyde E., Commander (MC) USNR (*Severe Iridocyclitis Treated with Penicillin*, p. 546). M.D., University of Colorado School of Medicine, 1920. Visiting surgeon: Colorado General Hospital; Denver General Hospital, 1920-25; assistant in ophthalmology, University of Colorado School of Medicine, 1923-25. Fellow: American College of Surgeons; American Medical Association; American Academy of Ophthalmology and Otolaryngology; member: Los Angeles County Medical Association; Los Angeles Society of Otolaryngology and Ophthalmology; Pacific Coast Ophthalmological Society. Diplomate: American Board of Ophthalmology; American Board of Otolaryngology.

- Heintzelman, John H. L., Captain (MC) USNR** (*Evaluation of the Cold Agglutination Test in Primary Atypical Pneumonia*, p. 433). B.S., University of Pittsburgh, 1924; M.D., University of Pittsburgh School of Medicine, 1927. Intern, 1927-28, and medical resident, 1928-29, Mercy Hospital; demonstrator: in physiology department, 1929-31, and in clinical medicine, 1929-32, University of Pittsburgh School of Medicine; assistant to chief of medical staff, Western Pennsylvania Hospital, Pittsburgh, 1931-. Fellow: American College of Physicians; American Medical Association; member: Pennsylvania State and Allegheny County medical societies; Pittsburgh Biological Society; Pittsburgh Pathological Association.
- Hildreth, Harold M., Lieutenant H-V(S) USNR** (*Hidden Dementia Praecox*, p. 483). A.B., University of Nebraska, 1927; Ph.D., Syracuse University, 1935. Psychologist, Syracuse Psychopathic Hospital, Syracuse, N. Y., 1932-37; instructor, 1937-38; assistant professor, 1938-40, and associate professor, 1940-, Syracuse University. Member: American Psychological Association; American Association for Applied Psychology; American Association for the Advancement of Science; American Orthopsychiatric Association.
- Hill, Joel M., Lieutenant Commander (MC) USNR** (*Hidden Dementia Praecox*, p. 483). A.B., Princeton University, 1921; M.D., University of Texas Medical Branch, 1926. Intern, Grasslands Hospital, Valhalla, N. Y., 1926-27; Bloomingdale Hospital, 1927-29; postgraduate work in Germany, 1929-31; Bloomingdale Hospital, 1931-34; Payne Whitney Psychiatric Clinic, 1934-36; private practice of psychiatry, 1936-. Member American Psychiatric Association.
- Hipps, Herbert E., Lieutenant Commander (MC) USNR** (*Fractures of the Carpal Navicular*, p. 467). A.B., Baylor University, 1925; M.D., Baylor University College of Medicine, 1929. Intern, Baylor University Hospital, Dallas, Tex. 1930; assistant, surgery, Torbett Clinic and Hospital, Marlin, Tex., 1931-32; resident in orthopedics, Texas Scottish Rite Hospital for Crippled Children, Dallas, 1932-34; postgraduate study, University of Vienna, 1934; private practice, Marlin, Tex., 1935-42; chief surgeon, Orthopedic Crippled Children's Hospital, Marlin. Fellow: American College of Surgeons; American Medical Association; member: American Academy of Orthopaedic Surgeons; State Medical Association of Texas; Falls County Medical Society. Diplomate American Board of Orthopaedic Surgery.
- Hobby, Albert W., Commander (MC) USNR** (*Lobar, Broncho-, and Atypical Pneumonia*, p. 438). M.D., Vanderbilt University School of Medicine, 1926. Intern, Wesley Memorial Hospital, 1926-27; postgraduate scholarship, Trudeau School of Tuberculosis, 1935; postgraduate work, Bellevue Hospital, N. Y., 1935; research work in tuberculosis, Grady Hospital, Atlanta, 1938; chairman, Atlanta Tuberculosis Clinic medical staff, 1939-42; associate professor of medicine, Emory Medical School; staff member, Georgia Baptist Hospital, Atlanta, Ga., 1933-42. Fellow: American College of Chest Physicians; member: American Medical Association; Medical Association of Georgia; National Tuberculosis Association; Fulton County Medical Society.
- Klotz, Ben, Lieutenant Commander (MC) USNR** (*Parafrenal Abscess*, p. 543). B.A., Johns Hopkins University, 1922; M.D., Yale University School of Medicine, 1926. Intern, Johns Hopkins Hospital, 1926-27; assistant resident and resident in surgery, Sinai Hospital, Baltimore, Md., 1927-30; private practice of urology, Baltimore, Md., 1935-40; instructor in

urology, Georgetown University School of Medicine, Washington, D. C. Fellow: American College of Surgeons; American Medical Association; member Mid-Atlantic Branch of the American Urological Association. Diplomate American Board of Urology.

Leberman, Paul R., Lieutenant Commander (MC) USNR (*Cultivation of the Gonococcus*, p. 409). B.S., New York University, 1925; M.S., University of Pennsylvania, 1927; M.D., University of Pennsylvania School of Medicine, 1931. Associate in urology, 1932, University of Pennsylvania School of Medicine; chief of clinic, urologic out-patient department, Hospital of the University of Pennsylvania; assistant urologist, Jewish Hospital, Philadelphia; associate urologist, Chestnut Hill Hospital, Philadelphia; consultant urologist, Norristown State Hospital, Norristown, Pa. Fellow: American College of Surgeons; American Medical Association; Philadelphia College of Physicians; member American Urological Association. Diplomate American Board of Urology.

Loe, Ralph H., Lieutenant Commander (MC) USNR (*Gastric Diseases in Navy Personnel*, p. 450). B.S., University of Washington, 1925; M.D., University of Pennsylvania School of Medicine, 1926. Intern, 1926-28, surgical resident, 1929, Hospital of the University of Pennsylvania; assistant surgeon, 1930-37, chief of a surgical service, 1937-41, gastroscopic service, 1936-42, King County Hospital, Seattle, Wash.; consulting surgeon, Swedish Hospital, 1940-42; gastroscopic service, U. S. Marine Hospital, Seattle, 1940-42. Fellow: American College of Surgeons; American Medical Association; member: Seattle Surgical Society; North Pacific Surgical Society; American Gastroscopic Club. Diplomate American Board of Surgery.

Lutz, Francis C., Lieutenant Commander (MC) USNR (*A Time-Saving Combination Sling*, p. 557). M.D., Jefferson Medical College, 1923. Intern: St. Christopher's Hospital for Children, Philadelphia, 1922; St. Joseph's Hospital, Philadelphia, 1923-24; private practice, Philadelphia, 1924—; surgical staff, Jefferson Medical College Hospital, 1924-41; genito-urinary staff, Pennsylvania Hospital, 1926-34; courtesy staff: Hospital of the Woman's Medical College of Pennsylvania; St. Joseph's Hospital; St. Mary's Hospital, Philadelphia. Member: American Medical Association; Medical Society of the State of Pennsylvania; Philadelphia County Medical Society.

Mayer, Henry, Jr., Lieutenant (MC) USNR (*Passage of Miller-Abbott Tube Through Pylorus with Aid of Electromagnet*, p. 463.) B.A., Princeton University, 1935; M.D., Columbia University College of Physicians and Surgeons, 1939. Research assistant, Medical Center, New York City, 1939; intern, 1940-42, and resident radiologist, 1942, Lenox Hill Hospital, New York City. Diplomate National Board of Medical Examiners.

McCann, William S., Captain (MC) USNR (*Choline Hydrochloride in Experimental Yellow Fever in Rhesus Monkeys*, p. 420). B.A., Ohio State University, 1911; M.D., Cornell University Medical College, 1915; D.Sc. (Hon.), Ohio State University, 1934. Served as First Lieutenant and Captain in the U. S. Army Medical Corps in Panama, France, and the Army of Occupation, World War I; formerly associate professor of medicine at Johns Hopkins University School of Medicine; instructor in medicine, Cornell University Medical College; Charles A. Dewey professor of medicine, University of Rochester School of Medicine and Dentistry, and physician

in chief (on leave of absence): Strong Memorial Hospital; Rochester Municipal Hospital, Rochester, N. Y. Fellow American College of Physicians; member: Association of American Physicians; American Society for Clinical Investigation; Society for Experimental Biology and Medicine; American Society of Biological Chemistry; American Institute of Nutrition; Harvey Society; American Clinical and Climatological Association. Diplomate and member American Board of Internal Medicine. Member Editorial Board of the Journal of Clinical Investigation.

McNair, Stirling S., Lieutenant Commander (MC) USNR (*Gonorrheal Ophthalmia*, p. 582). A.B., University of Alabama, 1925; M.D., Jefferson Medical College of Philadelphia, 1929. Intern, Hospital of the Protestant Episcopal Church, Philadelphia, Pa., 1929-31; formerly instructor in ophthalmology, Graduate School, University of Pennsylvania, and staff member: Pennsylvania Hospital; Children's Hospital, Philadelphia; and Abington Memorial Hospital, Abington, Pa.; private practice: Philadelphia, 1931-39, and Jackson, Mississippi, 1939-; staff member: Mississippi Baptist Hospital; Jackson Infirmary; Mississippi State Charity Hospital. Fellow American Medical Association; member American Academy of Ophthalmology and Otolaryngology. Diplomate American Board of Ophthalmology.

Menville, John G., Lieutenant Commander (MC) USNR (*Penicillin in Sulfonamide-Resistant Gonorrhea*, p. 423). B.S., Tulane University, 1928; M.D., Tulane University of Louisiana School of Medicine, 1930; M.S., University of Minnesota Medical School, 1936. Intern, Charity Hospital of New Orleans, 1930-31; surgical pathology, Bloodgoods' Laboratory, Johns Hopkins Hospital, Baltimore, 1931-32; urology, Squiers Urological Clinic, Medical Center, New York City, 1932-34; fellow in urology, Mayo Clinic, Rochester, Minn., 1934-36; instructor in urology, Tulane University of Louisiana School of Medicine; visiting surgeon (urology): Charity Hospital; Hotel Dieu, Sisters' Hospital; Touro Infirmary, New Orleans, 1936-41. Fellow: American College of Surgeons; American Medical Association; member: Orleans Parish Medical Society; Louisiana State Medical Society; Southern Medical Society; Louisiana Urological Society; Southeastern Branch of the American Urological Association. Diplomate American Board of Urology.

Monat, Henry A., Commander (MC) USNR (*Effective Management of Gastro-Intestinal Department at Naval Hospitals*, p. 459). A.B., University of Missouri, 1925; M.D., University of Arkansas School of Medicine, 1929. Intern, Gorgas Hospital, Panama, 1929-30; associate physician, U.S. Veterans' Bureau, 1931-35; private practice, specializing in gastro-enterology and nutrition, Washington, D. C. Fellow American Medical Association; member District of Columbia Medical Society; associate American College of Physicians. Diplomate American Board of Internal Medicine.

Newman, Louis B., Lieutenant Commander (MC) USNR (*Exercising Device for Increasing Joint Action*, p. 559). M.D., Rush Medical College, University of Chicago, 1931; M.E., Armour College of Engineering, Illinois Institute of Technology. Intern, Cook County Hospital, Chicago, 1932-33; department of physical medicine; Cook County Hospital; Loretto Hospital, Chicago. Fellow: American Medical Association; American Congress of Physical Therapy; member: American Society of Physical Therapy Physicians; American Society of Mechanical Engineers; Illinois State Medical Society; Chicago Medical Society.

Richter, John W., Lieutenant (DC) USNR (*Maxillofacial Kodachrome Photography*, p. 495). B.S., College of the City of New York, 1926; D.D.S., Columbia University School of Dentistry and Oral Surgery. Member: American Dental Association; Biological Photographers Association.

Rochester, Alfred M., Lieutenant Commander (DC) USNR (*Pain Relief*, p. 504). D.D.S., School of Dental and Oral Surgery, Columbia University, 1922. Private practice, White Plains, N. Y., 1924-. Member: American Dental Association; New York State Dental Society; White Plains Dental Forum (president, 1935).

Seligmann, Arthur W., Jr., Lieutenant (MC) USNR (*Evaluation of the Cold Agglutination Test in Primary Atypical Pneumonia*, p. 433). B.A., Columbia College, 1933; M.D., Cornell University Medical College, 1937. Intern, Mount Sinai Hospital, March 1938-Sept. 1940; clinical assistant, cardiac clinic, Mt. Sinai Hospital, New York, N. Y.; volunteer, cardiac clinic: Beth Israel Hospital; Hospital for Joint Diseases; private practice, New York City, Oct. 1940-. Member: American Medical Association; New York County Medical Society.

Sherman, Samuel R., Lieutenant Commander (MC) USNR (*Hazards of Carbon Tetrachloride in Present-Day Use*, p. 590). A.B., University of California, 1928; M.D., University of California Medical School, 1932. Intern: University of California Hospital; Mount Zion Hospital, San Francisco, Calif., 1931-32; surgeon, San Francisco Department of Health (Emergency Hospital Service), 1933-35; private practice, general surgery, San Francisco, until March 1942; staff surgeon, Mount Zion Hospital, San Francisco. Fellow American Medical Association; member: California Medical Association; San Francisco County Medical Association.

Smith, Joseph G., Lieutenant (MC) USNR (*Severe Iridocyclitis Treated with Penicillin*, p. 546). A.B., University of California, 1932; M.D., University of California Medical School, 1939. Intern, San Francisco Hospital, 1938-39; assistant resident in ophthalmology, 1939-40, and resident in ophthalmology, 1940-41, University of California Medical School Hospital; instructor in ophthalmology, 1941-42, University of Michigan Medical School. Diplomate American Board of Ophthalmology.

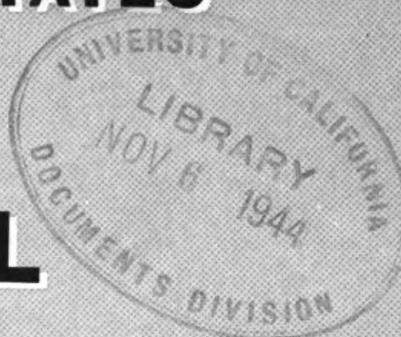
Taubenhaus, Leon J., Lieutenant Commander (MC) USNR (*Amebiasis as Cause of Recurrent Abdominal Pain*, p. 527). M.D., Tulane University of Louisiana School of Medicine, 1937. Intern, Kings County Hospital, Brooklyn, N. Y., 1937-39; resident in surgery, Mount Sinai Hospital, New York City, 1939-40; private practice, Houston, Texas, 1940-.

Vickers, Harry D., Lieutenant (MC) USNR (*Eighteen Months on an Attack Transport*, p. 513). A.B., Colgate University, 1929; M.D., Cornell University Medical College, 1933. Intern, Methodist Hospital, Brooklyn, N. Y., 1933-35; attending surgeon, Little Falls Hospital, Little Falls, N. Y.; division surgeon, New York Central Railway System. Fellow: American College of Surgeons; American Medical Association; member: Medical Society of the State of New York; Utica Academy of Medicine; Association of Surgeons of the New York Central System; New York and New England Association of Railroad Surgeons.

Zeve, Herman S., Commander (MC) USNR (*Modified Intensive Method for Treatment of Primary and Secondary Syphilis*, p. 429). M.D., Jefferson Medical College of Philadelphia, 1922. Intern, Philadelphia General Hospital, 1922-24; private practice, Youngstown, Ohio, 1924-42; associate urologist, Youngstown Hospital, 1924-42; consultant Youngstown Venereal Clinic; urologist, Mahoning Tuberculosis Hospital, Youngstown, 1924-42. Fellow American Medical Association; member Cleveland Urological Society.

11/55

UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

VOLUME 43

NUMBER 4



OCTOBER 1944

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

How occupational therapy may be brought to the patient, if the patient cannot go to occupational therapy, is demonstrated in this picture made at the National Naval Medical Center, Bethesda, Md. A WAVE officer instructs a Marine Corps major in a weaving exercise, prescribed by a medical officer, designed to help heal a radial nerve. This patient also suffered a shattered left ankle, fractured left femur, ununited fracture of the left humerus, and an injury to the right eye and ear.

—Official U. S. Navy Photo.

VOL. 43

OCTOBER 1944

NO. 4

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1945,
Public Law No. 347, approved June 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

See page II for prices

Digitized by Google

Original from
UNIVERSITY OF CALIFORNIA

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

III

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

Original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere, and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

PREFACE	III
NOTICE TO CONTRIBUTORS.....	IV
SPECIAL ARTICLES	
Planned Convalescence—Edward W. Lowman.....	611
Role of the Psychiatrist in the General Rehabilitation Program— Francis J. Braceland.....	621
A Program for the Rehabilitation of Psychiatric War Casualties; Role of the Convalescent Hospital—John B. Dynes, Francis J. Hamilton, and Robert A. Cohen.....	628
Physical Therapy in Aftercare of Amputations of Lower Extremity— Signe Brunnstrom	634
Scrub Typhus; Report of Epidemic in the Southwest Pacific—Joseph B. Logue	645
Meningococcic Infections—Walter M. Whitaker.....	650
Epidemic Diaphragmatic Pleurodynia; An Outbreak—Walter S. Mc- Daniel	664
Collapse of Intervertebral Disc Following Spinal Puncture; Report of Two Cases—F. Harold Downing.....	666
Fatigue-Stress Fractures; Diverse Anatomic Location and Similarity to Malignant Lesions—J. Gershon-Cohen and Robert E. Doran.....	674
Aerial Evacuation of Thoracic Wounded; Consideration of Effects of Altitude—Alfred Goldman.....	685
Anesthesia Aboard a Hospital Ship in Combat Areas—L. Kracer Fer- guson	697
Pathogenic Enteric Bacilli; I. Paracolon, Proteus and Pseudomonas Groups—LaVerne A. Barnes.....	707
Cold Hemagglutinins in Infectious Mononucleosis—Clifford L. Spin- garn, John P. Jones, and Bernard Owrutzky.....	717
Treatment of Marginal Parodontosis in Naval Personnel—James L. Bradley and Perry A. Ratcliff.....	720
A Modified Apicoectomy Technic; Indications and Application in the Field—Charles M. Moore.....	729
Low Incidence of Malingering Among Navy Draftees—Daniel H. Harris	737

VI	CONTENTS	Page
	Yaws Survey on Nanumea Atoll—<i>Ira D. LeFevre, Jr., Kenneth F. McDermott, and Robert B. Venner</i>.....	739
	CLINICAL NOTES	
	Spontaneous Rupture of the Malarial Spleen—<i>James M. Marshall</i>.....	743
	Primary Axillary Vein Thrombosis; Report of a Case—<i>Norman H. Bruce</i>	748
	Dermatitis from Blue Uniforms—<i>Cedric C. Carpenter and John W. Banzer, Jr.</i>	754
	Systemic Blastomycosis; With a New Form of Therapy—<i>Jack Fishman</i>	758
	Psoriasis Following Prickly Heat—<i>Robert R. M. McLaughlin</i>.....	762
	MEDICAL AND SURGICAL DEVICES	
	Cystoscopic Clinic at an Advance Naval Base Hospital—<i>Harry M. Spence</i>	763
	Simplified Method for Indirect Blood Transfusions—<i>Samuel J. Schneier-son</i>	766
	Conserving Water in Shipboard Dental Offices—<i>Mack Meradith</i>.....	771
	Mobile Surgical Unit Setup—<i>Donald E. Dement</i>.....	773
	EDITORIALS	
	Rehabilitation	775
	Medical vs. Surgical Management of Acute Appendicitis.....	776
	Mass Chemoprophylaxis	777
	BOOK NOTICES	
	Oral Histology and Embryology, edited by <i>Orban</i>—Oral Pathology, Thoma—Synopsis of Materia Medica, Toxicology, and Pharmacology, Davison—Strophanthin, Kisch—Medicine and the War, Taliaferro—Synopsis of Obstetrics, Litzenberg—A Textbook of Anatomy and Physiology, Anthony—The Chemistry of Synthetic Substances, Dreher.....	780
	PREVENTIVE MEDICINE	
	Toxic Effects of Arsenical Compounds As Administered in the United States Navy in 1943, with Special Reference to Arsenical Dermatitis—<i>T. J. Carter, Wesley M. Chambers, and Laura T. Anderson</i>.....	787
	Tsutsugamushi Disease—<i>Donald S. Farner and Chris P. Katsampes</i>.....	800
	Note on Taxonomy of Type Species of the Mite Genus <i>Trombicula</i> Berlese—<i>H. E. Ewing</i>	837
	NOTES ON OUR RESERVE CONTRIBUTORS.....	840

U. S. NAVAL MEDICAL BULLETIN

VOL. 43

OCTOBER 1944

No. 4

SPECIAL ARTICLES

PLANNED CONVALESCENCE

EDWARD W. LOWMAN

Lieutenant Commander (MC) U.S.N.

Planned convalescence is the full utilization of a patient's idle time in physical and mental pursuits with the threefold purpose of (1) returning him more speedily to duty, (2) furthering his military technical training, and (3) stimulating vocational and avocational interests which may later be of value in civilian or military life.

The British, at war long before the United States, turned their attention early toward the problems of convalescence and rehabilitation. They were the first to note that the idle monotony of prolonged convalescence viciously retarded a patient's normal recovery, that such idle waiting created a fatigue which impeded the progress of convalescence and even effected a physical deterioration.

The Tomlinson plan, which was adopted in Great Britain, not only provided for a program of "planned" convalescence, but also included the rehabilitation of men into civil life. In the convalescent program patients were no longer permitted to remain idle but were rapidly subjected in the early stage of recuperation to a full day's planned activity which included appropriate educational and occupational pursuits, graduated exercise, and entertainment. The results were spectacular in reducing the number of sick days and in returning men to duty in better physical condition than previously. Houlding (1) estimated that 90 percent of the men subjected to reconditioning returned to duty; furthermore 16 percent more patients were discharged to flying duties during the first 6 months of the program than in the 6 months preceding. This program was in effect when the United States entered the war.

In this country the young and progressive Army Air Force was the first to take cognizance of this successful venture; they immediately adopted and added to its best features. From experimentation came the Rusk plan. Today more than 26 million man-hours have been saved through use of this plan in the Army Air Force (2).

Under the Rusk plan patients are classified into groups in accordance with their stages of convalescence. As soon as able to take even the mildest exercise, the bed patient is placed in his first grouping. Every morning mild calisthenics such as simple leg exercises, rotary wrist motions, neck stretching, and the like are given. Throughout the day there is a complete schedule of activities; he does bedside occupational therapy projects, joins in ward discussions, and learns code, signaling, etc., with his fellow bedmates. As his convalescence progresses, he is placed in another grouping in which he joins in more strenuous daily outdoor calisthenics and gymnastics, attends educational classes and discussion groups, and at the same time actively participates in occupational therapy or Red Cross workshop projects. Finally he graduates to a group which is almost ready to return to full or limited duty status. He is then under strict military discipline in convalescent barracks where, aside from convalescent teaching, he undergoes final physical reconditioning.

In a summary of the first 15 months of experience, Colonel Rusk states (3): "The results of the convalescent physical training have been to: Reduce re-admissions by sending men back to duty in better physical condition, to shorten the period of convalescence in certain of the acute infectious and contagious diseases, and to eliminate in the majority of cases the necessity of sick leave. The results of convalescent teaching have been to: Teach new military skills and knowledge and increase the soldier's general knowledge. . ." Spot checks have shown a reduction in re-admissions of as much as 25 percent. In one hospital the average hospitalization for patients with scarlet fever dropped from 33 to 23 days. In a series of 645 cases of primary atypical pneumonia, run in two parallel groups, the average for those routinely treated was 45 days with a 30-percent recurrence; of those subjected to the reconditioning convalescent program, the average hospital stay was 31 days with only a 3-percent recurrence.

The most common malady in any military hospital is "hospital fatigue." It is a mental lethargy, an inanition, and a physical deterioration developing during early convalescence, in that stage of recuperation wherein the patient is no longer acutely ill but still not physically ready for duty.

In such a state a patient soon finds time weighing heavily. For a week perhaps he occupies himself adequately with cribbage, magazines and visits to the Red Cross recreation room. Tiring of these pursuits he becomes restless, impatient, and introspective. He learns the bad habit of wasting time. He looks forward more and more toward liberties when he can escape monotony. Finally upon receiving liberty as a reward for hospital detail, he spends this with a determination that leaves him in poor physical and mental state for his detail and less physically fit than ever in his convalescent state.

The cycle is a vicious one. The existence of this escape mechanism is unwarranted and could be eliminated through adequate prophylaxis against hospital fatigue, that is, through carefully planned convalescence.

Of 1,000 patients selected at random who were admitted and discharged from a Naval hospital in 1943 (4), the average stay per patient was 55 sick days (nearly 2 months); 324 remained less than 30 days; 316 more than 30 days and less than 60 days; and the remaining 360 were hospitalized longer than 2 months, 172 (or 17.2 percent) remaining longer than 3 months. Even with this relatively high average of sick days, actually only 550 (or 55 percent) of the patients returned directly to duty; 325 (or 32.5 percent) were transferred, the vast majority on convalescent leave transfer status; and 125 (or 12.5 percent) received medical discharges.

THE MECHANICS OF A PROGRAM

Primarily a program must be directed toward prevention of hospital fatigue through complete mental and physical occupation of a patient's wasted convalescent time, in an effort to return him earlier to duty.

Second, in a convalescent program, teaching (both academic and workshop) can be directed along lines of rate training. Although rate advancement may not be effected for a man on the sick list, still through training during convalescence he can be returned to duty well equipped to attain early advancement at his station.

Third, and of extreme importance, is vocational orientation and guidance. It has been said (5) that rehabilitation of our armed forces has been attempted following all previous wars but has never been successful. Vocational rehabilitation, strictly speaking, is not the responsibility of the services—that is, if we define vocational rehabilitation as “education in a physically and mentally suitable occupation adequate for social maintenance,” this is a job to be done by the Veterans' Administration and vari-

ous specific State and Federal organizations. However, of equal importance are vocational orientation and vocational stimulation.

By vocational orientation is meant the familiarization of a patient with various crafts and trades; by vocational stimulation, the arousing of a patient's interest in a specific craft or trade. A serious shortcoming after World War I was that too many were trained for objectives for which they lacked ability or scholastic background. There were 180,000 men who applied for training after World War I; more than 400,000 may be expected following this war (6).

The aims of a program may be more succinctly stated as follows:

1. To return men to duty status in the shortest possible time with maximum physical and mental capacities for performance of full duty.
2. To prepare the physically handicapped mentally and physically for competent and productive performance of limited duty.
3. To prepare both the mentally and physically disabled, through physical and occupational pursuits, for return to civilian life.

Administration of the program would rest with a rehabilitation committee composed of representatives from all hospital services acting in an advisory capacity, and the actual administration would be carried out through collaboration of the educational, athletic, occupational therapy, and physical therapy departments under the surveillance of a rehabilitation officer.

Several days after reporting into the hospital, each patient would be asked to complete a questionnaire prepared by the educational services officer, this form to include information regarding occupational interests, education, hobbies, training desired, etc., which might be of pertinent help in the planning of each patient's convalescent program.

It is important that reconditioning of the patient be introduced as soon as convalescence begins. Therefore with the exception of the acutely ill patient who is obviously unfit for extra activity, all patients on wards will be classified by the ward medical officers into one of four groups and each bed so marked. This grouping would be in accordance with the stages of convalescence.

Group I would include the bed patient or wheel chair patient who is recuperative and for whom limited bed exercises would be of benefit—i.e., the 1-week appendectomy, the 2-week herniorrhaphy, the afebrile pneumonia, etc. For this group, exercises would consist only of daily warming up maneuvers in bed.

Group II would consist of the ambulatory patient who is still unable to perform a work detail but who can tolerate and benefit

from a planned day of exercise, work, and occupational and educational projects—i.e., the ambulatory fracture case, the cardiac, the inactive rheumatic fever.

Group III would then include the ambulatory patient capable of performing a full day of moderately active work detail, workshop therapy and physical reconditioning.

Group IV. In this category are the patients medically fully recovered from their incapacities and eligible for a full routine of work and physical reconditioning.

The basic program for Group I would be low in physical training and high in educational and entertainment aspects, while for Groups II, III, and IV, physical and mental reconditioning through work therapy, classes, calisthenics and gymnastics would be paramount.

When a patient reached the stage of convalescence in which he could be classified in Group I, he would be interviewed by an educational services officer who would start him on an educational program. At the same time, the occupational therapy department would start the patient on a bedside occupational project, and the athletic officer would inaugurate morning exercises.

In the next group, exercises would be increased with the addition of compulsory outdoor gymnastics. At the same time the patient would begin a compulsory occupational therapy workshop program coordinated with an educational program. The workshops projects should be of technical, vocational, and avocational natures—machine shop, sheet metal, radio repair, plastics, photography, printing, painting, electrical work, carpentry, Diesel, etc. The educational program would offer classes of a corresponding nature such as code, radio, electricity, photography, navigation, Diesel, blinker, plastics, etc.

In the third stage the athletic activities would be expanded, the workshop and educational program continued, and a half day of light work detail would be required.

In the final group the activities would be continued with the substitution of a half day of full work detail in the place of light detail.

Every effort should be made to segregate patients on wards in accordance with the relative status of their convalescence—for example, all Group I pneumonia cases on one ward, all Group II pneumonia cases on another, etc. In addition men awaiting discharges should be segregated on wards apart from those men whose return to duty is anticipated. Progressive segregation or graduation of patients in group classifications from ward to ward not only simplifies administration but adds a tremendous psycho-

logic impetus to the patient's desire to get well; this impetus, or competitive spirit, is now absent with the general mixture on wards of seriously sick, the permanently maimed or disabled, and the recuperative patients. It should not be misconstrued that patients capable of prompt return to full duty after short illnesses would be unnecessarily retained in the hospital or on convalescent wards.

Physical therapy department.—The primary purpose of this department would be the treatment of specific disabilities of referred patients. The department should include electrotherapy, light therapy, hydrotherapy, mechanotherapy, fever therapy, and a gymnasium for corrective exercise. Patients should be referred individually and treatment prescribed by a medical officer in the department. The occupational therapy department would function under the supervision of, and in conjunction with, the physical therapy department, and all patients being referred for medical reasons to the occupational therapy department would be seen and prescribed for by the medical officer in charge of physical therapy.

The medical officer in charge of physical therapy as rehabilitation officer would supervise and coordinate the entire convalescent program.

Occupational therapy department.—The responsibilities of occupational therapy would be threefold: (1) Recreational therapy for bed patients (Group I) carried on by occupational therapists or by the Red Cross and volunteer groups under the direction of the occupational therapy department, hobby activities being correlated with the results of the educational services officer's classification survey.

(2) Medically prescribed active and active resistive exercises administered in an occupational therapy functional workshop for those cases requiring specific corrective procedures to be accomplished on bicycle saws, looms, sanders, treadle saws, etc.

(3) Supervision of all of the technical, vocational, or avocational workshops. For each shop it would be essential that at least one trained Navy enlisted man be permanently assigned to duty to instruct patients and to maintain the individual shops—a radioman for the radio shop, an electrician for the electric shop, and so on. Thus a permanent complement of a dozen or more men would have to be assigned to the hospital for duty in teaching and for shop maintenance.

Educational services department.—The responsibilities of the educational services officer would be: (1) Distribution of classification questionnaires to all new patients; (2) personal interviews with all new patients; (3) provision of self-teaching text-

books, visual aids, and individual aid for the Group I bed patient; (4) direction of the training program for all patients who have progressed beyond Group I in their convalescence; (5) provision of books, maps, and pamphlets on current affairs; conducting of ward and group forums to provide war information and map discussions; (6) provision of materials and aid in registering for correspondence courses for high school credit, college credit, and personal advancement through the United States Armed Forces Institute; and (7) provision of information and aid in securing credit toward high school diplomas.

Athletic department.—The responsibilities of this department would be: (1) The management of general ward calisthenics every morning, graduated in accordance with the group classification of the patients as follows: (a) For Group I, head and neck, respiratory, light arm and finger, light abdominal, and light leg and foot exercises; (b) for Group II, moderate arm and shoulder, moderate trunk and abdominal, and moderate leg and thigh exercises; (c) for Groups III and IV, body building, general reconditioning and resistance exercises.

(2) Supervising compulsory outdoor daily recreational athletics for all patients in Groups II, III, and IV: (a) For Group II, golf, archery, swimming, horseshoes, ping-pong, light bag punching, wall exercises, shuffleboard, darts; (b) for Groups III and IV, golf, swimming, badminton, volleyball, soft ball, touch football, boxing, medicine ball, drills, boating, basketball, weight lifting.

(3) Arranging special events and competitive contests for patients in Groups II, III, and IV.

SAMPLE SCHEDULES.

Group I: 0930-1000, ward calisthenics. Throughout the remainder of the day, *occupational therapy rounds* to promote ward projects such as wood carving, model ship building, leather work, watch mending, belt weaving, and the like. *Educational officer's rounds* to show instructive movies, to interview new patients, to distribute books relative to hobbies, crafts, Navy rates, and to conduct classes in ship identification, code, blinker, plane identification, semaphore, with the use of visual aids. *Entertainment* to consist of victrola concerts, games, radio programs, and visits of celebrities.

Group II: 0930-1000, ward calisthenics; 1000-1100, current events war discussion, educational movies; 1100-1230, mess; 1300-1600, workshop and classes; 1600-1730, mess; 1730-1830, organized sports; 1830-2200 optional—workshop, recreation, or classes.

Group III: Same as Group II with the exception of a half-day's light work detail in morning or afternoon in place of ward calisthenics and current events discussion.

Group IV: 0800-0900, outdoor calisthenics; 0900-1100, work detail or workshop and classes; 1100-1230, mess; 1300-1600, work detail or workshop and classes; 1600-1730, mess; 1730-1830, organized sports; 1830-2200, optional.

Liberty is a privilege to be granted patients on the basis of their cooperation in the convalescent program, their work, and the discretion of the ward medical officer. It is imperative that liberty be maintained at a minimum; a too liberal policy defeats a convalescent program from the standpoint both of a patient's work efficiency and of his sane, healthy living. The following schedule might function efficiently:

For Group II, one weekend twice a month; for Group III, every weekend liberty; and for Group IV, one night a week plus every weekend liberty. Liberties should extend on weekends only from Saturday noon until Monday morning; longer liberties such as 68 hours and 72 hours should be restricted to emergencies.

Leave should be discouraged until a patient has reached Group IV in his convalescence.

It is imperative that emphasis be centered on attractive diversional facilities to compensate for less liberal liberty allowances. Every effort should be exerted to provide a full program of diversified nightly entertainment. Maximum utilization of library facilities should be encouraged; workshops should be kept open nightly for those interested in continuing projects; lounges with snack bars, writing desks, and reception rooms should be provided. Table pool, bowling leagues, stage shows, celebrity personal appearances, writing clubs, amateur shows, patient dances, a glee club, an orchestra, and newspaper and magazine publications are only a few of innumerable possibilities.

To insure success of the program:

1. There must be adequate personnel assigned to the occupational therapy department, the educational services, the athletic and the physical therapy departments, and there must be a permanent complement of enlisted rated men assigned to duty to supervise shop operations and teaching. It is extremely desirable that this personnel be on permanent assignment. Inadequacy in any one of these departments defeats a program.

2. There must be ample housing and equipment for setting up the diversity of workshops needed. A program cannot be operated with one or two or three shops. There can be adequacy or inadequacy; there is no medium.

3. Recreational centers and facilities, now thoroughly inadequate, must be greatly expanded to provide lounges, movies, bowling alleys, musical instruments, snack bars, etc.

4. The program, being compulsory, must be attractive to the patient.

5. Work details should be kept at a minimum.

6. Teaching must be stressed as the primary objective of all workshops, and although considerable maintenance work can be accomplished there, maintenance must be incidental and of secondary importance.

7. With the elaborate and diversified visual aids available, a great portion of instruction can be accomplished through this medium.

8. The closest cooperation with State and Federal rehabilitation groups should be maintained. A record of convalescent work done should be entered in the service record of every patient, to be available to rehabilitation groups upon the immediate or ultimate return of the patient to civilian life.

9. It is imperative that there be complete understanding and cooperation on the part of both the medical and the administrative staffs.

10. There must be strong direction by a central rehabilitation office endowed with the money and the authority to act without the detriment of red tape. It is to be expected that initiation of such a program will be necessarily radical and the cost high, but if it is to be successful at this late date, it must be.

CONCLUSIONS

1. The value of planned convalescence has been adequately demonstrated by the British and by the U. S. Army Air Forces. Over twenty-five million man-hours alone have been conserved in 15 months by the Army Air Force program.

2. The primary objective attainable in an adequate convalescent program is the prevention of hospital fatigue and the consequent earlier return of men to duty status.

3. The second objective is that, through judicious use of classroom and workshop therapy, men may be trained in technical Navy rates during their idle convalescent time so that when returned to duty they may be better qualified to carry on their duties.

4. By inclusion of academic and workshop therapy of practical value in civilian life, a degree of vocational orientation and stimulation can be effected which may prove extremely valuable to ultimate civilian rehabilitation.

5. In a convalescent program there can be no timidity or inertia. At this advanced date, initiation of the program must be definitive and expeditious if the Services' part in rehabilitation is to surpass their ineffectual part in the first world war. The challenge is here to be met.

REFERENCES

1. HOULDING, R. N.: Rehabilitation of injured air crews. *Brit. M. J.* 2: 429-433, September 27, 1941.
2. KNIGHT, C.: Learn while you heal. *Air Force* 27: 14-16, April 1944.
3. Report of Baruch Committee on Physical Medicine, April 1944.
4. Personal survey, U. S. Naval Hospital, Corona, Calif.
5. JOHNSTONE, R. T.: Cited by KRUSEN, F. H.: Wartime physical rehabilitation. *Proc. Staff Meet., Mayo Clin.* 18: 344-352, September 22, 1943.
6. Medical News in *Arch. Phys. Therap.* 25: 49, January 1944.



SMALLPOX ON BOARD A DESTROYER TENDER

Signs and symptoms of smallpox were noted in a patient on board this vessel on 21 February 1944. The patient had arrived on board on 8 February coming directly to the ship from a 9-day leave in Los Angeles. He was restricted to the ship for gonococcus infection, urethra, on 9 February before he could receive any overnight liberty. Sulfathiazole was instituted immediately and continued until 16 February.

While still on the venereal restricted list he reported to the sickbay on 21 February with a rash on his body, face, neck and arms, and complained of fever, chills, headache and backache of 4-day duration. He was placed in isolation with "diagnosis undetermined (dermatitis contagiosa)." Pustulation occurred in all lesions on 23 February and a positive diagnosis of smallpox was made. This was considered to be an attenuated form of smallpox, as primary and accelerated reactions had previously been recorded for the patient.

The commanding officer was informed as soon as the diagnosis of smallpox was established. All personnel were vaccinated, beginning with the men in the patient's division and those in the sleeping compartment fore and aft of his division. A 97.6-percent "take" was recorded upon the first vaccination, and upon revaccination of the remaining 29 men an immune or accelerated reaction, read after 48 hours, revealed a "take" in 28 of the men. The remaining enlisted man was transferred to the hospital.

Contact clothing, bedding, mattresses, etc., were burned at sea. Upon transfer of the patient to a mobile base hospital, all clothing, bedding, mattresses, etc., were sent to the U. S. Naval Hospital, Aiea Heights, T. H., for autoclave sterilization. The isolation room was scrubbed down with lysol and green soap. The ultraviolet lamp was then employed for a period of 12 hours.

The diagnosis of smallpox was corroborated at the hospital and the patient retained in isolation.

No further cases, suspicious or apparent, appeared and quarantine was lifted on 2 March.—TENDLER, M. J., Commander (MC) U.S.N.R.

ROLE OF THE PSYCHIATRIST IN THE GENERAL REHABILITATION PROGRAM

FRANCIS J. BRACELAND
Commander (MC) U.S.N.R.

The role of psychiatry in the varied phases of a general rehabilitation program is an important one; in many instances proper consideration of psychiatric tenets will spell the difference between success and failure of the entire program. For purposes of this discussion the term general rehabilitation program will be considered to include not only convalescence and reconditioning following illness or injury, but also the eventual return of the individual either to full combat duty or to independent earning power in a civilian status. Naturally the physician in military service is most interested in returning his patients to full duty status, but failing in this, he realizes that it is incumbent upon him so to prepare his patient that his civilian confreres charged with rehabilitating the returned veteran will not be unduly handicapped.

The psychologic and emotional aspects of illness and convalescence in civilian life have not received sufficient attention. Patients recuperating from an illness have been advised to "go on a trip" or to "rest up" for a while but such advice salves the conscience of the adviser more than it aids the recovery of the patient, for one cannot "go away and rest" and leave his emotional state behind him. A patient who is emotionally distraught during an illness and a period of convalescence will continue to be distressed until some way out of his difficulties is found. In view of all of the emotional cross-currents which will be operative in the postwar reconstruction period, attention to the psychologic aspects of reconditioning and rehabilitation will be exceedingly important, and neglect of them will result in a program which is woefully deficient.

Not only will some of our returning military personnel be recovering from wounds and injuries, but also some of them will be embittered, disillusioned, insecure, and hostile. Some may feel that they have been dealt with unfairly and that they have suffered while others have gained. They have heard of the parades and addresses of welcome at the end of the first world war and have also heard that this emotionalism was quickly forgotten in the ensuing economic boom and the depression which followed it.

These are some of the factors which must be kept in mind if we are to be of real assistance to the men whom we aim to rehabilitate, and they all come within the purview of psychiatry.

Recovery, convalescence, and reconditioning are extremely important, and there is no question but that they will be expertly handled from a medical and surgical standpoint. There is no doubt about the ability of the internists to arrive at the proper solution of the difficult medical problems they will encounter, or that orthopedists will fit our men with appliances which will be more scientific than any which have been made heretofore. It is the man as a feeling person who will recover from the illness, and the man as a person of sensibilities who will wear the orthopedic appliance, about whom psychiatry is concerned. It is the person as a whole who should be treated, not merely the diseased part.

In the materialism of the last century, the individual was forgotten and medicine saw only the disease with its background of gross or microscopic pathologic change. Should this attitude be carried over into rehabilitation programs we will not succeed, for it is the individual who is sick or injured, and how his personality is affected for better or worse will govern his chances of rehabilitation. In its broadest sense, then, rehabilitation depends upon whether or not the individual as a whole is rehabilitable, and in the final analysis we are defied to rehabilitate any man who will not or cannot be rehabilitated.

The advent of psychosomatic medicine has furnished one of the answers to our problem, for it at least recognizes the presence of psychologic factors in all illness. Actually the psychiatrist is aware of the limitations of this term, for this dichotomy does not exist in nature. It is probable that all physical illness is apprehended at some level of consciousness; all psychic activity is undoubtedly accompanied by some biochemical change.

In the first world war the majority of psychosomatic ailments which were recognized seemed to be referable to the cardiovascular system, and we dealt with "soldier's heart," "disordered action of the heart," effort syndrome, and the like. In this war the emphasis, in diagnosis at least, seems to be upon gastro-intestinal ailments, despite our efforts to screen out those individuals who presented a history of frank disease of the gastro-intestinal tract. There is, however, a thread of continuity between these apparently disparate examples of illness: Both result from the impact of war and its accompanying emotional upheavals upon the particular personality types which are susceptible.

The work of the psychiatrist begins intensively immediately

upon the subsidence of the acute phases of an injury or illness. Heretofore psychiatry has been found wanting; it has been wholly dependent upon time-consuming individual treatments, and there were not enough trained psychiatrists to go around. In this war psychiatry has learned that it cannot concentrate upon the individual and permit the group to shift for itself. The Navy has learned perforce that one method of solving this problem is by group psychotherapy. This method, which originally began as an expedient, has been found to be extremely effectual. This should have been evident at once, for as a matter of fact, the patients were originally removed from a civilian group, they were trained and they fought in a military group, and now they live in a hospital group, so it is reasonable to suppose that they should be treated as a group. As Rome has stated, "they pool their collective insecurity, and find strength and security in the group."

Five or six group discussions on the medical or surgical wards will be found to be of great value to the patients. After a brief explanatory talk on the role of emotions in illness in general, and *their* illnesses in particular, the concepts of fear and insecurity can be discussed, and the patients are able to bring out emotional patterns which have heretofore been repressed. They are aided by the knowledge that they are not unique in the possession of their fears, their anxieties or their insecurities.

These sessions are not to be interpreted as lectures by the psychiatrist; they are group discussions, supplemented by whatever individual therapeutic periods may be required. This group therapy, in addition to occupational and educational therapy, will do much to shorten the period of convalescence and give the patient the proper start on the way toward complete rehabilitation. This is the role of psychiatry in the general treatment of the patient who is ill with the so-called psychosomatic diseases.

In the surgical wards psychiatry also has a part to play, not a mechanically measurable part, but nonetheless an extremely important one. What does it matter how mechanically perfect the artificial limb or the plastic device if the patient is not prepared psychologically to use it? If he remains depressed and insecure about his ability to carry on in the outside world, we have not done all that we can do for him.

When the hospital door closes on a patient his problem is not solved even though his operation was successful. The hospital is a world of unreality where the patient is cared for and everything is done for him, in contrast to the outside world where one does for oneself. We cannot pamper these patients, to be sure, nor can we wrap them in emotional or economic cotton wool, but we can

prepare them for the things they will encounter in a world which is changed for them because of their injuries. Things which are commonplace for most of us loom up as difficult ventures for a man on crutches, and such prosaic things as boarding and sitting down in a streetcar or going through a revolving door become hazards.

This does not mean that these individuals are to be shielded or sheltered, but simply that proper attention to the emotional elements which inevitably accompany any surgical procedure will aid in the recovery and adjustment of the surgical patient even as it does in the case of the patient with pneumonia or tuberculosis. Training by participation in a group project is the keynote of success in this phase of rehabilitation.

TREATMENT OF PSYCHOSES AND PSYCHONEUROSES

It is in the treatment and rehabilitation of the psychotic and the psychoneurotic patient that psychiatry naturally will find its largest field. It is encouraging to know that in this particular field the Navy has had a rehabilitation plan in operation for well over a year. This program has now expanded to such a degree that the basic idea of treatment and reconditioning is operative from the time the individual becomes a neuropsychiatric casualty on some Pacific atoll or island until the time he is considered recovered or is discharged to the Veterans' Administration facilities for further treatment.

At the present time there are psychiatrists at the front with the Marines and on hospital ships with the fleet, whose duty it is to judge the extent or depth of the illness and to decide upon the disposition and treatment of the patient. Those patients who will respond quickly and can be returned to duty are treated in the nearest hospital facility. The remainder are returned to the psychiatric hospital for the area and here the rehabilitation process is begun at once. Upon the return of neuropsychiatric patients to the United States, they are again examined and sorted, some being sent to convalescent hospitals and others admitted to the neuropsychiatric treatment wards of the general hospitals.

The Navy has already learned a great deal about the convalescence and rehabilitation of patients with combat and operational fatigue and the various mild forms of psychoneuroses. The term "combat fatigue" was introduced with rehabilitation in mind. Unlike that unfortunate nosologic venture in the last war, the so-called "shell shock," the term "combat fatigue" implies that recovery will take place after removal from combat and subsequent rest, and no one will be able to trade upon this diagnosis

after the war is over. The Navy uses it only as a working diagnosis and judiciously applies it to a syndrome which occurs too regularly and too uniformly to ignore.

All patients diagnosed as having combat or operational fatigue as well as the other mild forms of neuroses are placed under treatment soon after their arrival in this country. Those who are adjudged not fit to return to combat or limited duty are prepared for their eventual return to civilian life, and an effort is made to make better citizens of them by means of reorientation discussions. In both instances group therapy is the method of choice, and the patients are kept in a controlled atmosphere for 24 hours a day. The number returned to duty from the group therapy installations varies from 50 to 80 percent. Without these therapeutic units most of these men would be lost to the service.

One very definite fact the Navy psychiatrists have learned about the rehabilitation of neuropsychiatric patients is that these patients do not do too well in isolated resorts no matter how beautiful the surroundings. More and more we are inclined to believe that the convalescent centers should be placed somewhere near an urban area which can be designated as a liberty port. Excellent rehabilitation work, in fact some of the best, is being done in the group therapy wards of some of the large general Naval hospitals, and this in itself seems almost prophetic, as if it portended the return of psychiatry to the fold of general medicine where it rightfully belongs.

The military phase of the rehabilitation of psychotic patients is proceeding at a gratifying pace. The number of psychotic illnesses occurring in the Navy is well below the number expected, and far below the psychotic rate in the civilian population. In the two large hospitals to which psychotic patients are eventually transferred, the recovery rate is 65 percent returned to their homes symptom free within the first 3 months, and 20 percent more within the next 3 months. This is an excellent record, in or out of the service. Although recovery from the acute phases of the psychotic illness is only the first step in the general rehabilitation plan, it is the principal concern of the military psychiatrist, and the remainder of the task will come under the cognizance of some other agency.

EDUCATION OF PUBLIC

Another phase of the rehabilitation program which will require most careful consideration is the question of the environment into which the ex-serviceman will return. It has already been stressed that the problem is not what we can give the veterans but how we can help them to help themselves. To create surroundings

calculated only to aid the handicapped might result in prolongation of the individual's idea that he is handicapped. As a matter of fact, an individual is only handicapped as much as he permits himself to be, no matter what his original illness or injury. Some men have turned what appeared to be an insurmountable handicap into an attribute by using it as a spur toward the perfection of other faculties. This also is part of the role of psychiatry, the inculcation of proper morale in the group which is to be rehabilitated.

It would be of little use to carry out all the steps in a perfect rehabilitation program and present the veteran fully prepared to take his place in normal life, only to find that the people in the community to which he returns persist in regarding him as abnormal. The wounded veteran will be the recipient of national attention at the close of the war, but someone must take some measures to prepare the niche into which he will be fitted. In order to accomplish this enormous task, the instrumentalities will have to be proportionately large. Newspapers, radio, moving pictures and audio-visual aids are the most productive media in getting ideas across to the public. They have been useful in selling bonds and in seeking blood donors so they should be equally useful in helping to adjust the men for whom these things were accomplished.

In order to carry the rehabilitation program to its logical conclusion, not only must the attitude of the returning veteran be made sufficiently flexible to enable him to adapt to changed circumstances, but the public at large must be acquainted with the usefulness of partially disabled persons. This will be new to America, for we have been a relatively young, lusty, healthy, sprawling country, profligate in the use of manpower as well as of natural resources. It has been repeatedly stressed by industry as well as by the military services that a man must be fit for all duties or for none at all, and this all or none theory is the psychologic barrier which the returning veteran has to hurdle. In the unemployment periods which are bound to follow the war, even though they will be largely controlled, the competition for jobs will be keen and employers will require applicants to be unhampered by illness or injury. They will ask why they should use a handicapped man when completely healthy ones are available, for this is typical of our competitive commercial attitude. Saving, conservation of resources, and use of the partial services of manpower reserves have only recently become part of our national economy.

Psychiatry has a part to play in these sociologic problems; it must, as a corollary of its interest in rehabilitation, help to change

some of these prevailing attitudes which we as a nation have developed. The problem will be upon us before we realize it; some rumblings have already been heard. Men discharged from the service with a neuropsychiatric diagnosis already find difficulty in getting work in some localities. Anyone who understands psychoneurotics realizes that it only takes two or three rebuffs to make some of these men unemployable and beyond rehabilitation, and some other branch of our Government will find itself with a stupendous problem on its hands.

The attitude of wastefulness of the capacities of the limited, the attitude of profligacy supported by the feeling that there will always "be more where that came from," will have to be corrected. The public at large must realize that this war will make a difference not only to this generation but also to the next. In an effort to overcome some of our indebtedness to the future, any program dedicated to general rehabilitation will have to prepare the environment to which the veteran returns in a better fashion than was done following the previous war. This does not presume rash changes in our national economy, but it does mean education of the public regarding the proper attitudes toward returned veterans.



ADRENAL GLANDS AND DISEASE

In 125 cases in which autopsy was done the adrenal glands were studied in an effort to correlate medullary changes with systemic diseases.

The histophysiologic criteria of Elaut served as a guide to the evaluation of the activity of the medulla. The measurement of 100 cells and 100 nuclei by means of a micrometer eye piece gave the best information on the function of a given medulla.

In neoplastic diseases and in long-standing infections the activity of the medulla was decreased. High activity was noticed in injuries of the brain, diabetes, obesity and thyrotoxicosis. Twenty-six cases of hypertension not associated with inflammation of the kidneys were included. In all except two histologic evidence of hyperfunction of the medulla was present. The grade of activity did not depend on the weight of the heart or on the presence of renal insufficiency.

The results support the theory that in the early stages of essential hypertension hormonal factors play a substantial and primary role.—DRAKE, R. L.; HIBBARD, J. S.; and HELLWIG, C. A.: Adrenal medulla in various diseases; histophysiologic study. Arch. Path. 37: 351-358, June 1944.

A PROGRAM FOR THE REHABILITATION OF PSYCHIATRIC WAR CASUALTIES

ROLE OF THE CONVALESCENT HOSPITAL

JOHN B. DYNES

Lieutenant Commander (MC) U.S.N.R.

FRANCIS J. HAMILTON

Lieutenant Commander (MC) U.S.N.R.

and

ROBERT A. COHEN

Lieutenant Commander (MC) U.S.N.R.

Despite careful preventive measures, thousands of psychiatric war casualties in need of care and treatment are now returning to the United States from combat or operational zones. There was a brief influx of acute psychiatric casualties following the attack on Pearl Harbor, but this did not overtax our hospitals or create a serious problem in care. In the months that followed there was a steadily increasing rate of admissions to psychiatric wards, and many of these disorders were definitely related to the stress of combat, convoy, and operational duty at sea. When the casualties from Guadalcanal and the South Pacific combat zones began returning to this country in increasing numbers, the problem of the psychiatric war casualty became a pressing one.

The Surgeon General of the Navy recognized the urgent need of adequate provision for these casualties, and through the Division of Neuropsychiatry in the Bureau of Medicine and Surgery a program was instituted for the rehabilitation of these patients. Since the first world war psychiatrists have hoped for an opportunity to treat the psychiatric war casualty before his symptoms became fixed.

There is much speculation regarding the location of hospitals that have as their primary purpose the treatment of psychiatric war casualties. The results of treatment at the front or aboard ship are said to be surprisingly good, and there is no question that excellent work is being done in combat zones. However a large number of men have a recurrence of nervous symptoms or develop their nervous disorder some time after their combat or operational experience.

Many believe that psychiatric treatment units should be located outside of combat zones, but sufficiently near so that there would be little delay in treatment. No one would question the soundness of this policy. Yet since many psychiatric casualties show sig-

nificant improvement only after returning to the United States, it appears that there will always be a large number who will require treatment at home.

The locations chosen for convalescent hospitals are important. They should be close to the source of supply of patients. They should have access to entertainment, recreation and work facilities, either within their own walls or readily accessible. The natural beauty of the surroundings is less important to the average patient than adequate recreational facilities. Most of them would prefer one night on "the great white way" to a month in the most scenic spot in the world. Therefore it has been suggested that each Naval hospital formulate and operate its own rehabilitation program for psychiatric casualties. Although this suggestion is a logical one, there are many difficulties inherent in such an approach. The routine work of handling the mass of detail and the additional administrative duties imposed on the medical officer might leave little time for concentrated effort on the problem of rehabilitation. We believe that an autonomous unit, operated by carefully selected personnel, should be established in Naval hospitals. There is no reason why the program outlined here could not be applied to any hospital.

The officer personnel appointed to a convalescent or rehabilitation hospital for psychiatric war casualties should have special adaptability and enthusiasm for their work and an ability to transmit this enthusiasm not only to patients, but to the entire personnel of the hospital. An atmosphere of "recovery" should be created and maintained. It must be remembered that we are dealing with patients whose nervous symptoms in most instances have been present for many months. Frequently they have had treatment elsewhere and have lost hope of recovery.

In order to establish this atmosphere of recovery, lectures should be given to the entire personnel of the hospital. This includes civilian employees. Thus a certain esprit de corps will be created, and the cooperation and understanding of all will be secured. The psychiatric patient is frequently viewed with some misgiving and actual alarm by the layman. Explanatory talks given to the general personnel of the hospital will alleviate these fears. Often the psychiatric wards are held in considerable opprobrium by occupants of the other wards, and this attitude has a definitely disturbing effect upon psychiatric war casualties.

Trained psychiatric nurses and hospital corpsmen are of inestimable help in the care of these patients and in creating an atmosphere of confidence. It is suggested that each corpsman have the direction of groups ranging from 10 to 20 patients. He should

be responsible for a progress chart on each of his patients, and should also foster a spirit of competition with other groups in regard to activities (athletics, work, recreation) about the hospital. The corpsmen and nurses should meet with the psychiatric staff at weekly intervals.

The psychiatrist frequently has little control over the non-medical members of the hospital staff, but these members are also important to the smooth operation of the rehabilitation effort. Discipline must be maintained; a proper police force will not only insure that patients who are physically able perform the tasks assigned to them, but that they do not get out of control when on liberty. The athletic director, the recreational and educational officer, and the chaplain are of great help in supervising activities, in counseling, in directing the patient's interests, and in creating emotional outlets. These officers direct special programs which are integral units of the general program.

An important aspect of this program is the selection of suitable patients. Certain mental disorders are totally unsuited for treatment in a convalescent hospital. The psychotic, the psychopathic and the mentally defective must be excluded, and the patient who presents evidence of long-standing neurotic symptoms will probably be little benefited by this program. The full cooperation of the Naval hospitals referring patients to the convalescent hospitals is essential.

It is the purpose of the daily program to fill each day with activities. If the convalescent hospital is restricted to psychiatric patients only, the problem is simplified, as every patient may be included in all activities and there may be uniform rules for work, recreation, and liberty. A typical schedule is as follows.

Daily Schedule at a Convalescent Hospital

0700.....Reveille.
0715.....Muster.
0715-0730.....Calisthenics.
0730-0800.....Breakfast.
0830-0900.....Morning ward rounds.
0900-1100.....Morning work detail alternating with educational program.
1100-1200.....Group discussions (psychotherapy).
1200-1300.....Lunch.
1300-1400.....Free period (letter writing, etc.).
1400.....Muster.
1400-1630.....Athletics, group games, hikes, etc., under supervision.
1630-1730.....Rest, showers, dress.
1730-1830.....Dinner.
1900-2200.....Recreation, movies, illustrated talks by naturalists, liberty,
under supervision.
2200.....Lights out.

An attempt is made to divert and interest the individual in a variety of ways, mainly through group activities. It is evident that patients convalescing from pulmonary, cardiac, gastro-intestinal, or orthopedic conditions cannot be expected to fit into a program involving work, athletics and recreational activity. There is, however, an advantage to those patients whose primary disorder is not psychiatric, in participation in group discussions.

In general it can be said that most neuropsychiatric war casualties are physically able to take part in group activities and to do a certain amount of work, although effort may be poorly sustained. Invariably these patients clamor for leave and liberty. We have had best results by granting rewards and privileges to those who show a satisfactory performance of work assigned and evidence of interest and cooperation in the athletic and recreational program, as well as in the group psychotherapy discussions.

Military discipline within the hospital has also proved of definite value. Certain rules and regulations are accepted if issued as orders. It helps to "save his face." It may be argued that a system of reward for cooperation on the part of the patient does not give the patient any fundamental understanding of his nervous disorder; and if we stopped there, one of the aims of psychotherapy would not be attained.

Group therapy by means of discussions and explanatory talks is considered one of the chief cornerstones of the rehabilitation program. Group therapy is not a new method of dealing with psychiatric disorders, but it has not been applied widely to psychiatric war casualties. It is particularly beneficial for those psychiatric casualties who are returned to the United States and have had their incapacitating nervous symptoms for many months.

It is not the intent of this type of psychotherapy to probe individually or at great depth. When the patient first arrives at the convalescent hospital a brief admission examination is carried out. This calls attention to certain psychotic patients, and to the more serious mental disorders, and provides an opportunity to prescribe appropriate disposition if it is found that the patient cannot be adequately treated at the convalescent hospital. Within the next few days a detailed history is taken and a physical and psychiatric examination is made.

Very few patients were excluded from the group psychotherapy discussions, as experience showed that although fixed symptoms in certain cases could not be altered, it was worth while to give

each man an opportunity to express himself and obtain an outlet for his resentments. Many patients of this type, although not cured, have left the hospital with an attitude which was no longer hostile. Many expressed a feeling that they had been treated fairly and had hopes and plans for the future. This contrasts sharply with those patients discharged from the service who return to their homes in an unhappy frame of mind and immediately become candidates for veterans' aid, instead of making an attempt to help themselves. The period of hospitalization varied with the individual case. The average hospital stay was 5 or 6 weeks.

Suggestions and explanations given to the group often had more force than the same suggestions and explanations given individually. Group therapy reinforces the bond between the individual and the group which makes it possible for him to return to the dangers and rigors of modern warfare. It is a powerful adjunct to morale, and it induces in each patient the feeling that his reaction was not weak or abnormal and therefore to be feared, but only the natural result of the fatigue and tension under which he fought. It instills confidence in many patients whose symptoms have been chronic for months and makes for better adjustment, either within the service or in their own communities. In addition, it enables the psychiatrists to treat a larger number of patients.

Experimentally, groups of various sizes were treated here. At one time as high as 60 patients attended group discussions, but this number was found to be too large. A group of 15 to 25 men was preferable. Control over the group was enhanced if the leader of the discussion included only patients whom he had examined personally and knew their history and background. It was thought at first that patients might be grouped symptomatically, but this plan was soon abandoned as it was apparent that, although all patients did not have identical symptoms, there was a striking similarity of symptoms in these psychiatric combat casualties. In addition the men had a curiosity and interest in symptoms other than their own, and the variety of symptoms in any group made discussions more forceful and convincing.

It became the policy to discuss general topics in the opening lecture. The purpose of the group meetings was laid before the assembly, and the nature of the benefit to be derived was explained in general terms. It was soon discovered that the more aggressive members took over the discussion to the exclusion of the shy or passive members. In order to draw out the latter it was found profitable at the second meeting to ask each man to

state before the group his principal nervous symptoms. The psychiatrist was already familiar with the patient's symptoms and could direct the discussion. Symptoms were discussed in general terms and specific secrets or sensitive points were protected; the individual patient was not embarrassed.

In subsequent meetings general topics were discussed, such as personality and its development, individual similarities and differences, and the emotions and their influence on the mind and body. Discussions of such topics as nervousness, tension, startle reaction, fear, worry, anger, love, resentment, frustration, depression, fatigue, sex, sleep, dreams, and pain were carried on from day to day. Simple talks on physiology and anatomy seemed to hold attention and elicited many questions. Diagrams on the blackboard, illustrations in books, and charts seemed to be especially valuable. Topics such as heart trouble, gastro-intestinal disorder, headache, backache, weakness, and the influence of disease on the total personality, were also discussed with the group.

A few patients who had recovered from their nervous symptoms were retained and acted as aids, taking part in the group discussions and exerting a powerful influence upon other patients, as they demonstrated by their behavior and presence in the group that recovery was possible.

The explanations and the language used in these discussions were always as simple and direct as possible. Psychiatric terms were avoided. The discussions had to be carried out at the lowest intellectual level of the group.

The program requires a type of cooperation difficult to attain, but it is worth the effort, as the immediate results have been better than might have been expected in patients whose nervous disorders had been present for many months. Approximately 50 percent of the patients were returned to duty and 80 percent were definitely improved. The real test of such a program is the test of time—the ability of these men to tolerate stress in the future, either in the service or under the trying conditions that may be present at home. This particular aspect of the problem was not neglected in the group discussions. It is our personal belief that such a program would not only save the taxpayer enormous sums in the future, but in addition, and of greater significance, a large group of men would be saved from becoming chronic nervous invalids.

PHYSICAL THERAPY IN AFTERCARE OF AMPUTATIONS OF LOWER EXTREMITY

SIGNE BRUNNSTROM

Lieutenant, junior grade W-V(S) (H) U.S.N.R.

At a recent meeting of allied surgeons in Toronto, Canada (February 1944), four "sites of election" were agreed upon as producing satisfactory stumps:

1. *Syme's*—a transmalleolar amputation. To cover the amputation surface, a posterior skin flap which includes the fatty subcutaneous tissue of the heel is utilized. This gives a good end-bearing stump.

2. *Midleg*—an amputation through the middle third of the leg about six inches below the knee. In all midleg amputations the fibula is retained although it is cut shorter than the tibia. Longer stumps are to be avoided, since such stumps usually have poor circulation, are sensitive, and are hard to fit with a prosthesis. Shorter stumps, through the upper third of the leg, are unsatisfactory because they do not provide sufficient leverage for knee action.

3. *Stokes-Gritti*—the femoral condyles are removed and the patella is fused to the end of the femur. It gives a good weight-bearing surface.

4. *Midthigh*—the ideal site is at the junction of the middle and lower third of the femur, although a true midthigh amputation is also quite satisfactory. Amputations through the upper third of the femur do not give as good results. In midthigh amputations skin flaps (but no muscular tissue) are used to cover the end of the stump.¹

PHYSICAL THERAPY MODALITIES

Heat in some form is often used to improve circulation of the stump and to relieve pain. For circulatory effects contrast baths are particularly recommended. The contrast bath by producing an alternate vasodilatation and vasoconstriction has a more beneficial effect on the circulation than has the hot or warm bath. As a rule long periods of water treatment should be avoided, since they tend to soften the skin. (The skin should be toughened rather than softened.)

¹ Disapproved: Disarticulation of hip; disarticulation of knee; any amputation through the tarsal bones, leaving only the calcaneus and the astragalus, which invariably causes equinus position of the stump.

Pressure exercises are given for the purpose of toughening the stump in preparation for weight-bearing. The patient is instructed to push the end of the stump against a firm surface with increasing force. At first only a light tapping can be tolerated. Gradually the stump can take a great amount of pressure.

Massage as a routine procedure should not be employed, since it may cause a traumatic neuritis in the sensitive nerves of the stump. However in selected cases it may be used as an aid in reducing edema and for loosening of scar tissue. To employ massage for the purpose of reducing the size of the stump would be a waste of time. It has never been proven that massage reduces fatty tissue. Shrinking of the stump gradually occurs because of atrophy of muscles not in use. It is furthered by firm bandaging.

Most important for the amputee is the exercise program which, in the following pages, will be dealt with in more detail. It is in planning this program and in supervising its execution that the physical therapist can be of great value.

EXERCISE PROGRAM.

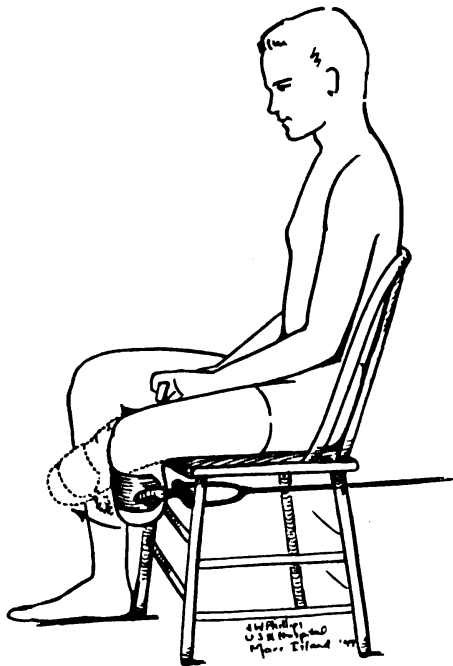
To obtain a well functioning stump it is necessary for the patient to go through all motions of the remaining joints as soon as his condition permits. The motions have a fourfold purpose:

1. To improve circulation and thus nutrition to the stump.
2. To maintain flexible joints.
3. To promote muscular tone and to increase muscular strength.
4. To develop coordination.

The first duty of the physical therapist postoperatively is to ascertain that the stump is maintained in the best possible position so as to prevent contractures. One must be particularly on guard against *knee flexion*, *hip flexion* and *hip abduction* contractures. Such contractures are frequently seen in amputees whose bed posture has not been carefully supervised.

Knee flexion contracture most commonly occurs in midleg amputations. The natural reaction to injury or pain is the withdrawal from the injuring agent and the pain. This constitutes the "protective reflex of flexion." This reflex may, at least partially, be responsible for the appearance of flexion contractures. The stump is sensitive, and to protect it the patient, consciously or reflexively, pulls it closer toward him. The flexed position is most comfortably maintained in the side-lying position. It is not uncommon to see midleg amputees lying on the affected side, keeping both hip and knee in flexion. Even with a skin traction of several pounds the position does not become corrected, unless the patient at the same time is given definite instructions in regard to posi-

tion. For the comfort of the patient, during the first few days after amputation, a small pillow may be allowed under the knee, but it should be removed as soon as possible. The patient remains in the back-lying position, or turns over to the prone position, but is not allowed to stay on his side for any length of time. Active knee motions are encouraged at an early stage, the motion of extension being emphasized at all times.



1. A cuff around the stump is attached to a weight over a pulley in such a manner as to resist knee extension.

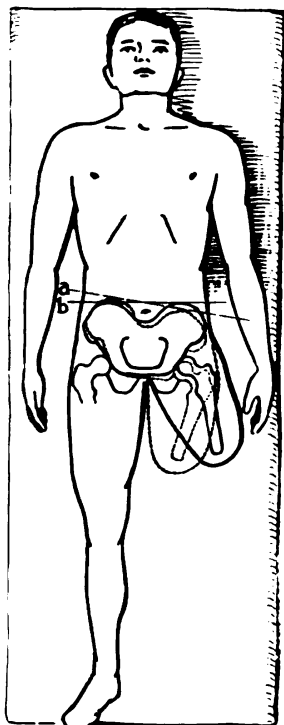
The quadriceps femoris is systematically trained by lengthening the daily exercise periods and by increasing the amount of resistance given. Quadriceps "setting" is practiced frequently, but it should be remembered that active joint motion is far more effective for strengthening of this muscle. Since, in amputation cases, the quadriceps no longer has to work against the weight of the foot and the leg, simple knee extension against gravity is not sufficient, but resistance must be applied. Such resistance may be given manually or by means of weights and pulley (fig. 1).

Should a flexion contracture already be present, assistive stretching of the contracture may be given, provided the patient is able actively to assist the motion.

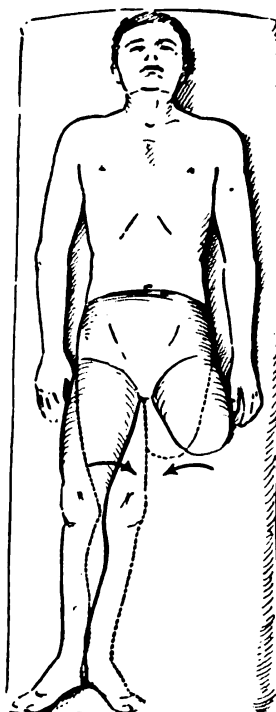
In many cases, however, the knee flexors are hypersensitive to stretching and immediately respond by contracting, when an attempt is made to elongate them (increased stretch reflex). In such cases it is wise not to attempt any manual forced stretching of the flexors, but to emphasize active resistive quadriceps contraction. In calling upon the quadriceps to contract, an attempt is made to make use of the pattern of "reciprocal innervation" to obtain hamstring elongation. It is not unusual to see tight hamstrings, even spastic ones, gradually getting soft during active resistive knee extension. In the presence of hamstring spasm, only a small amount of extension is attempted, the range being increased very gradually. Best results are obtained if during such training the hip joint is extended, or nearly so. Since the hamstrings originate above the hip joint, hip flexion would put

these muscles on a stretch from above, and, with the added pull from below, when knee extension is performed, a reflex contraction is likely to occur. Knee extension in combination with hip flexion would not be attempted until considerable progress in hamstring relaxation had been made.

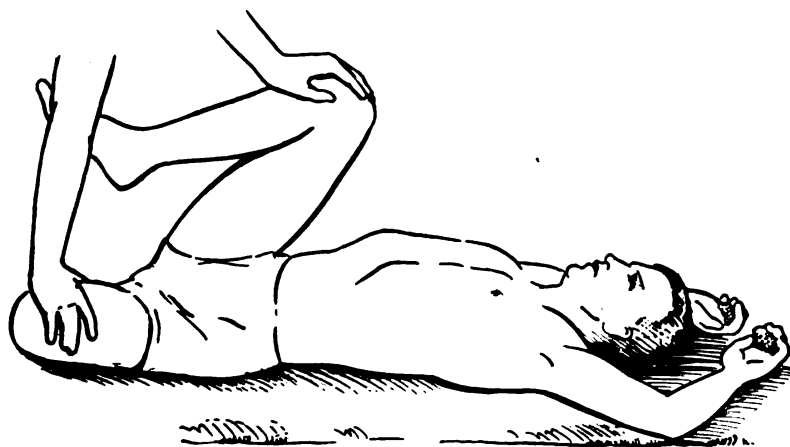
In stubborn cases of knee flexion contractures, when spasm is



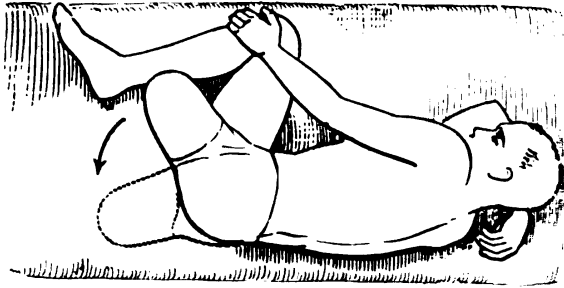
2. (a) Pelvic obliquity caused by traction on stump. (b) With correction of the pelvis the abduction contracture becomes obvious (left).



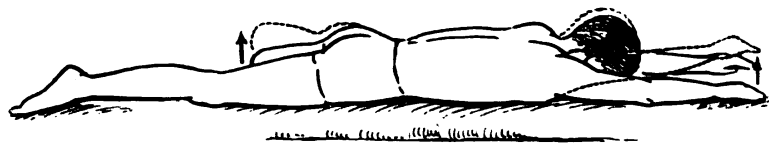
3. Adduction and internal rotation of the thighs with pelvis "squared" (right).



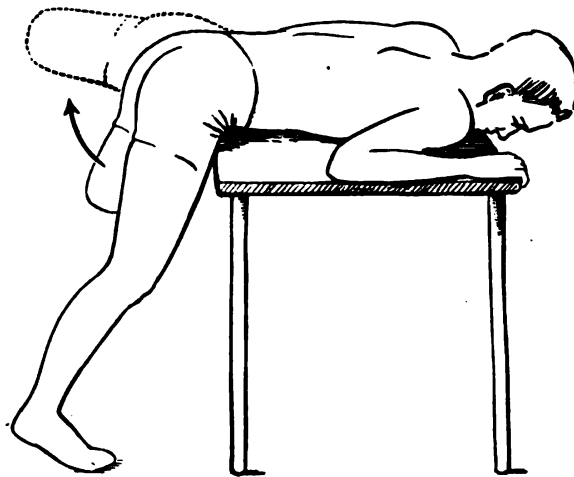
4. Assistive hip extension for flexion contracture of hip. Unaffected thigh is flexed to prevent motion of pelvis and lumbar spine.



5. Side-lying active hip extension. Opposite hip is flexed to prevent motion of lumbar spine.

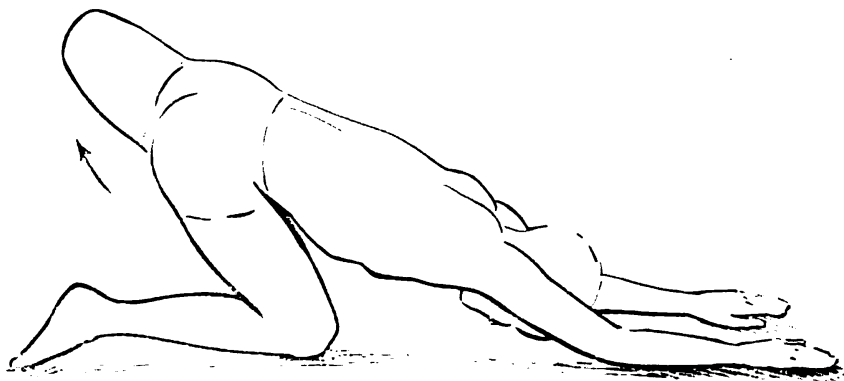


6. Prone-lying hip extension. Care is taken not to abduct thigh while extending it. Raising the opposite arm prevents twisting the body.

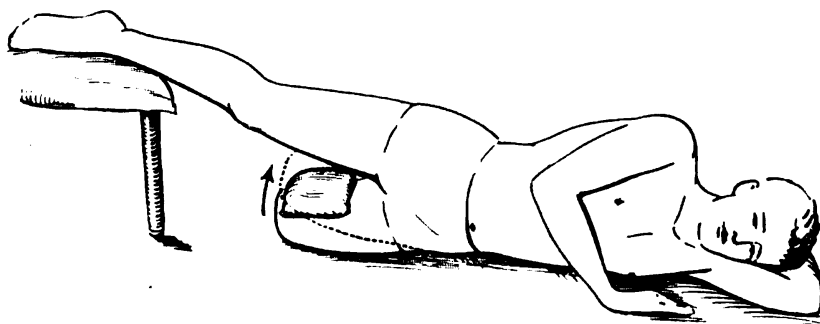


7. Hip extension for increasing range of motion.

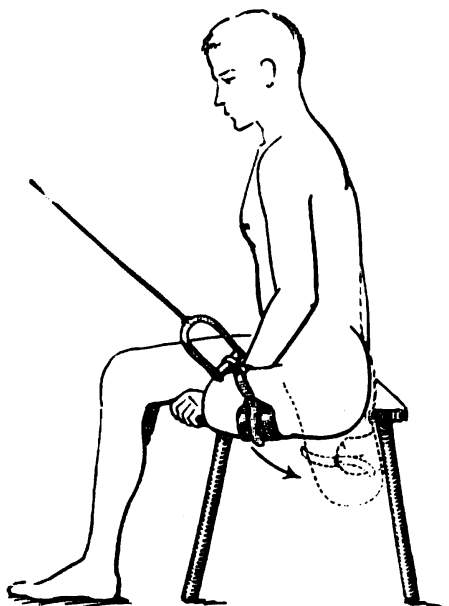
present, and when in addition changes in ligaments and capsule may have occurred, a cast may have to be applied or traction resorted to. To be effective, traction must be of long duration. "Lengthening reaction" may occur after the muscle has been pulled upon steadily for five minutes, but it may take as long as thirty minutes or more to bring about, depending upon the severity of the spasm. Traction is particularly effective during sleep when muscle spasm is diminished or absent and when muscle tone is decreased.



8 Hip extension combined with spine straightening. Change to prone lying and push up again.



9. Adduction of stump against resistance of weight.



10. Resistive extension of stump.

In below-knee amputations, while the attention is centered on quadriceps training, all muscles around the hip joint, back and abdominal muscles are also exercised, and the principles of good posture are explained. Since the unaffected leg in many respects has to do double duty, care must be taken not to strain it. Pro-

longed standing is discouraged, particularly if the arch is weak. If the shoe seems ill fitting, a special shoe may be indicated, and a consultation with the ward medical officer is arranged.

Hip flexion contracture is often seen in amputations above the knee, rarely in below-knee amputations. Supporting the stump on a pillow may make the patient more comfortable, but it is not a desirable posture since it maintains the stump in a flexed position. The same faulty position exists when the patient sits up in bed. To prevent a hip flexion contracture from developing the stump should be kept flat on the bed. Several times each day the amputee should turn over to the prone position, thus securing full extension at the hip. Prolonged sitting is discouraged. Gluteal contraction and active hip extension in the prone-lying position are begun as early as possible.

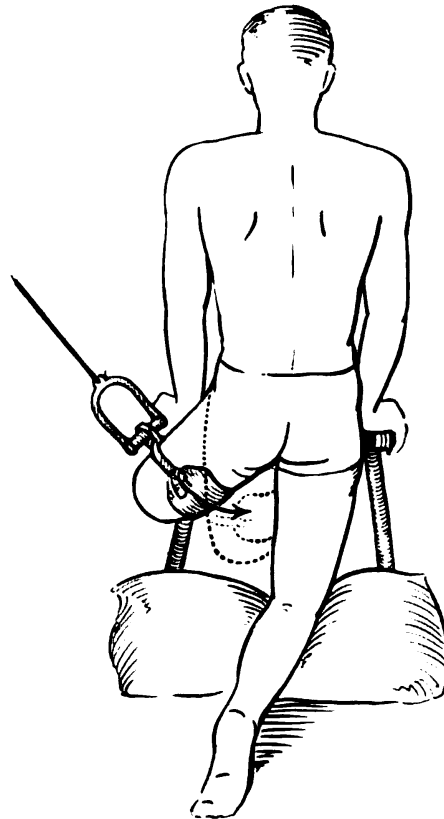
The development of a hip flexion contracture may be due to direct muscular imbalance as well as to faulty bed posture. In a thigh amputation the balance between hip flexors and hip extensors has been disturbed. The pectineus and the iliopsoas, two strong hip flexors, are intact. On the extensor side, the hamstrings and the adductor magnus have been severed. Unless and until the severed muscles gain a new insertion on the stump, hip extension will be weak and unbalanced. The gluteus maximus, without the aid of the hamstrings and the adductor magnus, will tend to rotate externally and to abduct the thigh as it extends it. Special hip exercises, as outlined in figures 3 to 13, will help to restore muscle balance.

Hip abduction contracture, like hip flexion contracture, must be guarded against in above-knee amputations. Its appearance may be explained both on the basis of faulty bed posture and on the basis of muscle imbalance. When skin traction is applied to the stump without pelvic fixation, the pelvis will tend to tilt toward the side of the traction. Thus in a left thigh amputation the left side of the pelvis will be lowered. With the traction directed straight downward toward the foot of the bed, the thigh is in a straight line with the body, but because of the pelvic obliquity the position of the left thigh is one of abduction in relation to the pelvis, while the right thigh is adducted (fig. 2a). Maintaining this asymmetrical position for some time may result in a more or less permanent abduction contracture of the stump. Should the traction, erroneously, be applied in an oblique direction, the condition is greatly aggravated. In the presence of an abduction contracture, after traction has been discontinued and the obliquity of the pelvis has been corrected, the abducted position of the stump becomes very obvious (fig. 2b).

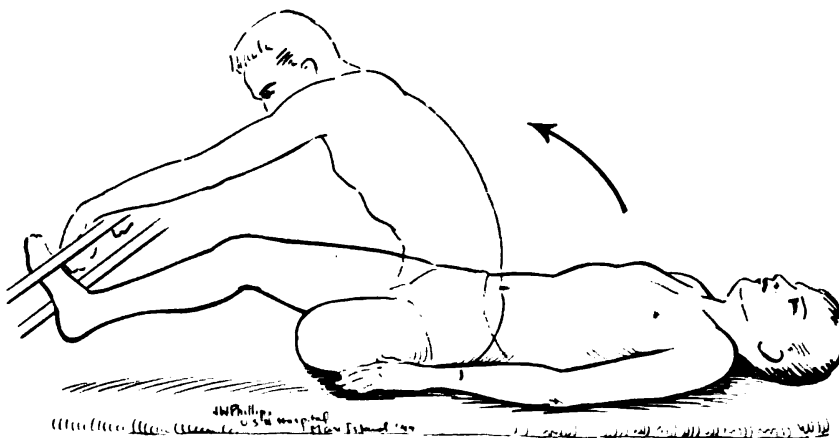
The abductor-adductor imbalance resulting from a thigh ampu-

tation is caused by the severance of the adductor muscles. The abductor muscles, on the other hand, inserting into the greater trochanter, are intact, and tend to pull the stump into an abducted position. The thigh offers little or no resistance to abduction, since the weight of the extremity is greatly reduced. Walking on crutches without weight-bearing on the stump does not improve the condition; in fact, it aggravates the pelvic obliquity and with it the abduction contracture.

Walking with a prosthesis will be very awkward and inefficient if there is a flexion or abduction contracture, or both. In the former case the pelvis cannot be well balanced on the femoral heads but will be tilted forward, causing a lumbar lordosis. In the latter case

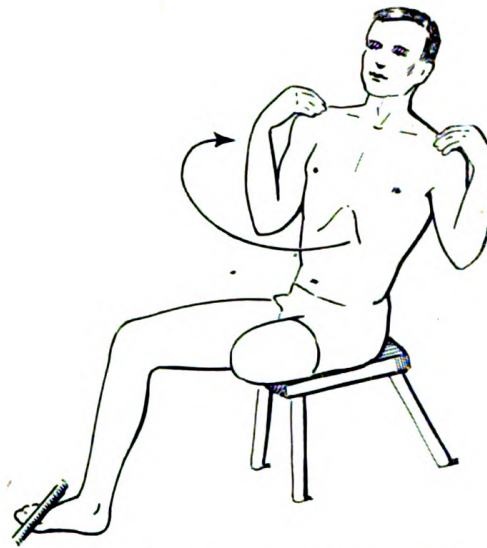


11. Resistive adduction of stump.



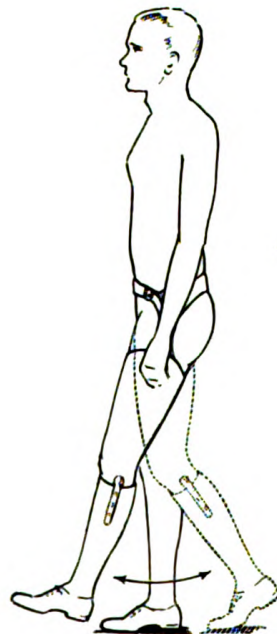
12. For general flexibility and strengthening.

the artificial leg will seem too long and will remain abducted, making proper weight-bearing impossible. A combination of the two constitutes a real handicap. Instead of utilizing a free pendulum motion at the hip joint, the amputee will get into a habit of swinging his artificial leg sideways, keeping the knee extended. When the body weight is transferred to the artificial leg, since the hip joint cannot be fully extended, the pelvis remains tilted

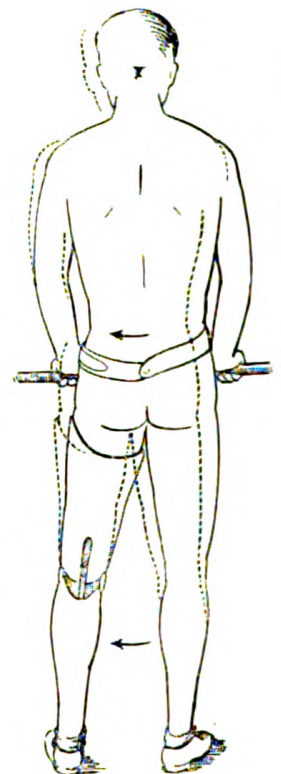


13. Trunk-twisting with body inclined backward for strengthening of the abdominal muscles.

forward. The trunk compensates by deviating posteriorly in an attempt to bring the center of gravity of the suprapelvic structures in line with the weight-bearing femoral head. Frequently at the same time both arms are swung backward which further disrupts the natural rhythm of walking. Not only does this state of affairs make the gait very unsightly and slow, but it causes undue strain in the



14. Learning to transfer weight to prosthesis.



15. Learning knee action and pendulum motion at hip.

16. (a) Transferring weight forward on affected leg. (b) Rocking backward to starting position.

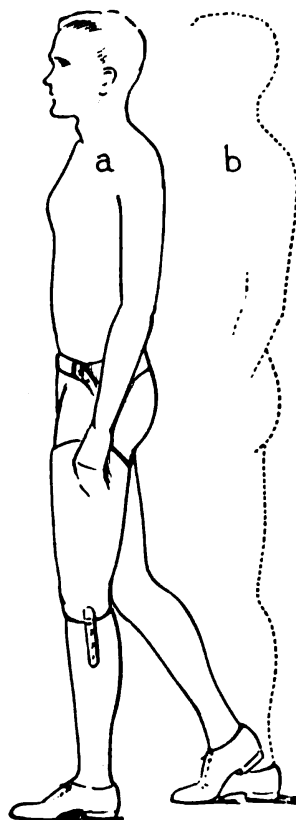
sacroiliac and lumbar regions, often accompanied by pain, and it overstretches the abdominal muscles.

To prevent contractures and to develop muscular strength and coordination the bed posture of the amputee is checked at regular intervals, and he is put through a series of daily exercises designed to restore muscle balance around the hip joint. The exercises are first carried out by each patient individually under close supervision, at which time the purpose of each exercise is explained carefully. Group exercises are begun as soon as practicable. By having several amputees practicing together the element of competition enters, in and the exercise period can be made more interesting and stimulating.

Some of the nonweight-bearing exercises used for thigh amputations are illustrated in figures 3 to 13.

The sooner the patient can be fitted with a pylon the better. Weight-bearing on the affected leg brings all the muscles around the hip joint into play and strength and coordination are developed. A long period of crutch walking should be avoided also from the standpoint of posture, since it often leads to faulty postural habits. Pelvic side tilting tends to be aggravated. It is not unusual to see the amputee standing "hanging" on his crutches, his back curved and his head forward.

If the nonweight-bearing exercise program has been carried out assiduously, the amputee has very little difficulty in learning the coordination necessary for walking with a prosthesis. A few simple weight-bearing exercises are illustrated in figures 14-16. These are followed by supervised walking on crutches, in a "walker" or with two canes, later without canes. Any swinging sideways of the affected leg is immediately stopped. It is to be insisted upon that the motion be strictly forward-backward, and that no circling sideways be allowed. Knee action is a "must" from the beginning. The steps should always be of equal length. Remember that it is better to do a small amount of correct walking than to walk a long distance incorrectly. Faulty habits are easily acquired but they are hard to break.



SUMMARY

1. Importance of correct bed posture immediately following amputation is stressed.
2. Knee flexion, hip flexion and hip abduction contractures must be guarded against.
3. Straight alinement of pelvis and thighs is obtained by "squaring" the pelvis, by avoiding the use of a pillow under the stump, and by encouraging the prone position.
4. Active nonweight-bearing exercises are begun at an early stage. All parts of the body are exercised. The motions of knee extension, hip adduction and hip extension are particularly emphasized.
5. When attempting to overcome contractures, manual stretching of tight muscles is avoided. Instead the pattern of "reciprocal innervation" is made use of to secure relaxation.
6. True contractures, involving capsule and ligaments, are overcome by the application of plaster or by continuous traction.
7. The early use of a pylon is recommended.

ACKNOWLEDGEMENT.—The drawings are the work of Lt. J. W. Phillips, W-V(S) (H) U.S.N.R.



THALASSOTHERAPY

Thalassotherapy is the utilization of ocean climate in preventing and treating disease. Its main factors—sun, air and water—act by their influence on the skin and the mucous membranes as receptor organs. The blood and the autonomic nervous system are used as conductors of their effects; thereby acclimatization is achieved, with the endocrine system acting as a possible "pace-maker."

The rationale of thalassotherapy includes (a) a sojourn at the seashore (a stay of 6 to 8 weeks) and (b) selective utilization of climatic factors under partial or complete (institutional) supervision.—SINGER, C. I., and PHILLIPS, K.: Thalassotherapy. J.A.M.A. 124: 1128-1133, April 15, 1944.

SCRUB TYPHUS

REPORT OF EPIDEMIC IN THE SOUTHWEST PACIFIC

JOSEPH B. LOGUE
Captain (MC) U.S.N.

Scrub typhus fever is an acute febrile disease caused by *Rickettsia orientalis*, which is conveyed to man from infected lower animals, mainly rodents, by the larval mite *Trombicula akamushi*.

Scrub typhus is endemic in many islands of the Southwest Pacific, especially New Guinea, New Britain and adjacent islands which have been occupied by American and Australian troops. The topography of these islands is similar. Many are of volcanic origin with low, flat coastal areas which rise steadily to volcanic peaks in the central portion of the islands. Many of these volcanoes are still active. The coastal plains extend from the ocean for varying distances to the high plateaus and peaks, many of them miles in extent. The areas are covered by a dense tropical rain-forest interspersed with areas of kunai grass. This is a tall, coarse grass which grows to a height of ten to twenty feet and is so thick that the ground is constantly wet.

These areas make excellent harborage for rats and other rodents, which are apparently the intermediate host for this disease.

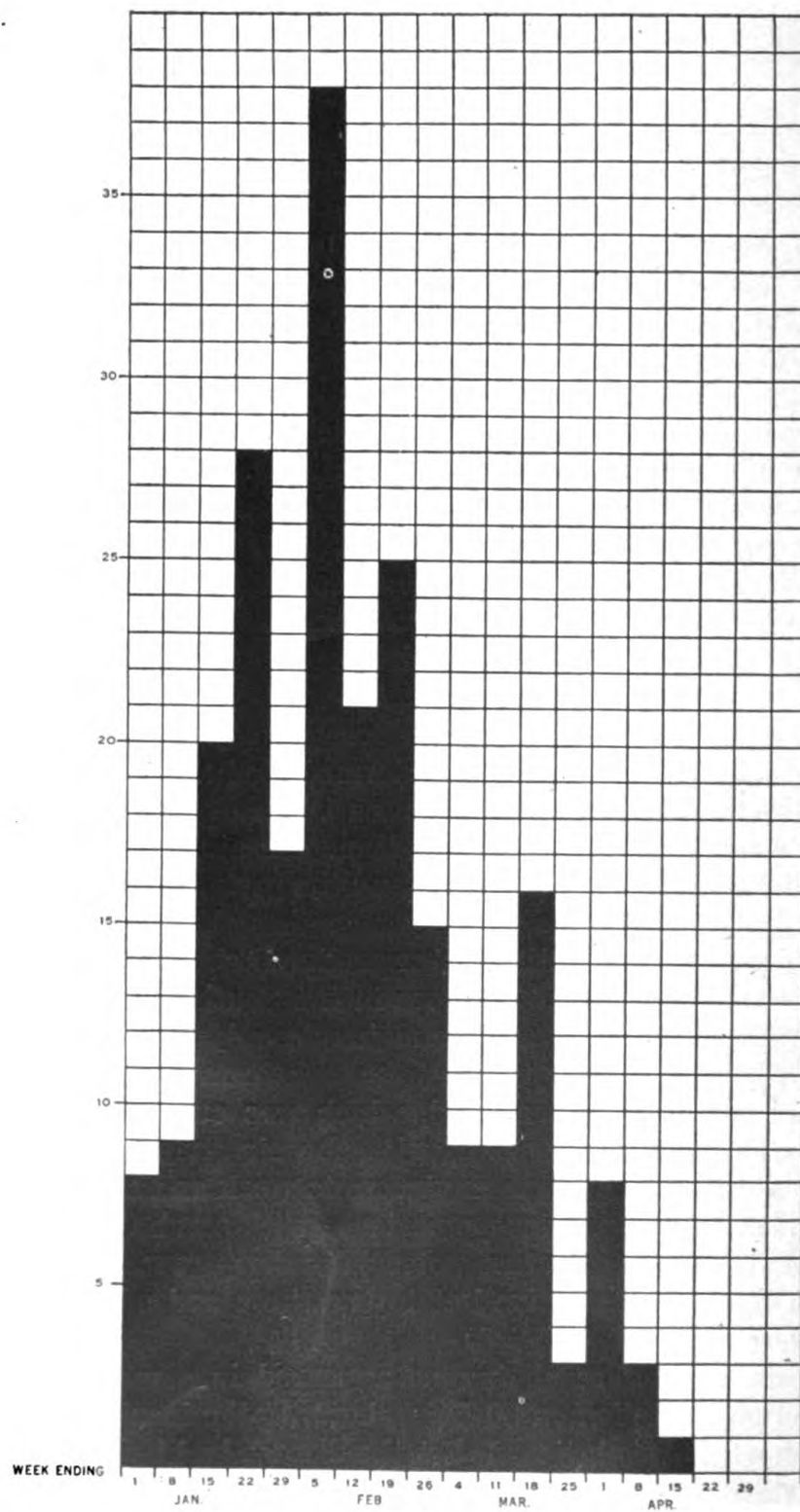
Our troops landed on one of these islands 26 December 1943. A beach-head was soon established and the airfield was captured several days later. Fighting to extend the perimeter lasted several weeks. The troops were actually engaging the enemy or doing extensive patrol duty until we were relieved about 30 April 1944.

This island was typical of those in the Southwest Pacific area. After penetrating the swamps and jungles adjacent to the beach, it was necessary for our troops to patrol through and bivouac in the kunai patches. The airfield, which was our main objective, was an extensive kunai patch, with the air strip in the center. This required all troops and engineers to work and bivouac in the kunai grass. From previous experience with scrub typhus it was known that these areas were potentially dangerous. The tactical situation left no alternative but to use these and adjacent areas which were similar.

The first case of scrub typhus appeared in a member of the Construction Battalion on 30 December. As the incubation period was so short, it was believed that the disease had been contracted in a previous staging area which was known to be infected. This observation was proved incorrect as soon as new cases developed,

SCRUB TYPHUS

WEEKLY ADMISSIONS
FROM
26 DECEMBER 1943 TO 30 APRIL 1944.



up to a peak of 38 cases for the week ending 5 February 1944. The number of cases developing daily gradually subsided until the first week of April, when there were only three cases. No cases developed from 13 April to the date of our departure on 30 April. There was a total of 230 cases with 22 deaths, a mortality rate of 9 percent.

Vigorous preventive measures were instituted and rigidly enforced. As all personnel were familiar with the disease and its control, active cooperation was immediately obtained. The entire area was divided into eight inspection areas with a medical officer assigned to each area. Over each four areas a supervising medical officer was assigned. The following routine measures which were initiated by the Sixth Army were enforced.

Chiggers (*Trombicula akamushi* larvae), the mite which transfers the virus (*Rickettsia tsutsugamushi*) of "bush typhus" (*tsutsugamushi* disease) from infected rodents to man, having been found in such numbers in certain areas of New Guinea and islands adjacent thereto as to constitute a great nuisance as well as a hazard to the health of the command, the following measures will be taken:

CAMP SITES.

- a. Avoid poorly drained kunai grass areas when selecting camp sites. Where possible, burn over camp sites and the areas adjacent thereto.
- b. Unless camp sites have been burned over, remove:
 - (1) Grass.
 - (2) Shrubbery.
 - (3) Leaves.
 - (4) Rubbish.
- c. Spray ground on which tents are pitched with an insecticide or thin oil.
- d. Treat walks as in (b). In heavily infested areas, walks which are sanded or graveled will be sprayed weekly with a thin oil.
- e. Keep to prepared trails and roads when practicable. Do not sit or lie on ground.
- f. Leave no food in or near camp accessible to rodents.
- g. Destroy or remove rodent cover about camp.
- h. Destroy rodents by traps or poison.
- i. For individual protection, dimethyl phthalate repellent in 2-ounce bottles and insecticide powder in 2-ounce shaker-top cans are obtainable from the Quartermaster for protection against larval mites.

Dimethyl phthalate.—Apply to the legs from the knees to include the ankle; work the repellent thoroughly into socks, tops of shoes or boots, top and bottom of leggings, and into the trousers from the knees down, also apply to the waistband and the fly of the trousers. If the clothing is thoroughly treated this repellent is, according to reports, effective for several days and will withstand washing in cold water.

Insecticide powder.—Use the powder around the waist and on the ankles; inside leggings or jungle boots. On returning from excursions into infested areas, go over skin of trunk and extremities (except genitalia) lightly with cloth moistened with kerosene, bathe well, and put on fresh clean clothing if available.

In addition to these measures, educational programs were instituted so that all personnel were familiar with the disease and with preventive measures. There was a meeting of all inspecting officers every two weeks to discuss their numerous problems and to report on progress made. Weekly inspection reports were required.

A typical case of typhus fever, scrub type, showed the following history and physical and clinical findings.

The incubation period was from four to eighteen days. The onset was characterized by chills, fever, and malaise with moderate fever. There was usually found the typical eschar with regional adenopathy. The eschar was located in a variety of places—the feet, legs, thighs, groins, abdomen, axilla, back of the neck, and in one instance in the eyebrow region. In four to eight days a macular rash usually developed over the abdomen, chest, arms, and thighs, which disappeared in a few days.

There was a gradual increase in fever with marked prostration, anorexia, restlessness, intense frontal headache and impaired hearing. These symptoms reached a peak from about the tenth to twentieth day, with the patient in extremis. If the condition was not fatal, the temperature dropped by lysis, and there was a gradual recovery. Death resulted from myocardial failure with bronchopneumonia. Meningeal irritation was usually pronounced. There was relative leukopenia. The spinal fluid was clear with cellular increase and increased pressure.

Treatment is entirely symptomatic. Careful nursing is of paramount importance. Supportive treatment, consisting of intravenous fluids, plasma, and small transfusions of blood, is necessary. Oxygen therapy is useful in all serious cases. Withdrawal of spinal fluid when indicated seems to relieve to some extent the severe headaches. Penicillin appears to be of no value. Serum from patients who have recovered from the disease has been reported to be of no value.

Autopsy findings are typified by the following report on a Marine private first class.

The subject was a fairly well nourished young male. There was an area of healing erosion over the bridge of the nose (probably caused by irritation of the oxygen mask). There were several small ulcers 2 mm. in diameter over the anterior wall of the chest. The brain showed moderate edema and there was moderate congestion of the cerebral vessels but no evidence of focal necrosis, hemorrhage or thrombosis.

About 30 cc. of yellowish fluid were contained in the pericardial sac. The right auricle was very prominent, the right ventricle moderately dilated. There was no evidence of coronary or valvular disease.

A small amount of yellowish fluid was found in both pleural cavities. Both were solid and had lost crepitation along the posterior surface. Cut surfaces

were reddish, and bloody, frothy fluid was easily expressed from the bronchi. The liver was enlarged 4 fingerbreadths below the costal margin; the cut surface revealed moderate congestion. A few old bands joined the gallbladder to the greater omentum. The spleen was reddish purple and had old fibrous adhesions to the omentum. The cut surface was reddish, the pulp scraping away easily.

The stomach was markedly dilated and contained a moderate amount of undigested food. There was patchy submucosal ecchymosis. The kidneys were normal in size, the capsules stripping easily and the cut surface exhibiting moderate congestion. The pancreas and adrenal glands appeared normal.

The gross diagnosis was: (1) Eschar left iliac crest, (2) cardiac dilatation, (3) bronchopneumonia, (4) patchy ecchymosis of the gastric submucosa, and (5) moderate congestion of liver and kidneys. Histopathologic examination was not made.

CONCLUSIONS

Definite areas of high infectivity were found, all of them in the kunai patches on the flat coastal areas where the soil was always damp. The kunai grass on higher, well drained slopes was comparatively free. The natives were aware of these endemic areas and would not live there. Kunai grass areas made excellent harborage for the multitude of field mice and other rodents. The damp ground was ideal for the development of the larval mite.

The possibility of seasonal incidence of the disease cannot be eliminated. However, there was very little difference in the temperature or relative rainfall during this time.

The active preventive measures instituted are believed responsible for the control of the epidemic.

The mortality rate of 9 percent is considered low in comparison to that reported from this disease in Japan. The experience of the Japanese in these islands was similar to ours but their mortality rate was higher.

Patients who recover from scrub typhus should have a long period of convalescence prior to returning to duty. This is especially true of those returning to combat duty. Patients returning to duty in this area after several months of convalescence have complained of severe fatigue and palpitation accompanied by a rapid pulse on exertion. After light duty for several weeks they have not improved sufficiently to warrant their retention in a combat zone. The probability of permanent myocardial damage should be given further consideration.

There is no known specific treatment for scrub typhus. Careful and efficient nursing with supportive treatment will keep the mortality rate at a minimum.

Efforts to develop an immune or prophylactic serum or vaccine should be intensified.

MENINGOCOCCIC INFECTIONS

WALTER M. WHITAKER

Lieutenant Commander (MC) U.S.N.R.

Many of our present-day concepts of the processes involved in the pathogenesis of meningococcic infections originated in the first world war, but have failed to receive proper recognition. Herrick (1), observing an epidemic at an Army post in 1918, stated that 45 percent of the cases could be recognized in the blood stream, or premeningeal stage, and that a small percentage of such cases failed to progress to signs of meningeal involvement. Gwyn (2) in 1899 grew the organism from the blood stream and knee-joint fluid in a patient who had meningitis, indicating the importance of the blood stream infection in the disease, and shortly thereafter the possibility of blood stream invasion occurring occasionally without the development of meningitis, was appreciated.

It is the purpose of this report to elaborate on the present-day conception of the pathologic processes in meningococcic infections and to note the clinical manifestations observed in a study of 116 cases at the U. S. Naval Hospital, Farragut, Idaho, during the 13-month period from 15 January 1943 to 15 February 1944.

Today we have come to regard infection resulting from the meningococcus as divided into three definite phases with certain clinical signs and symptoms peculiar to each stage. The three phases are (1) the nasopharyngeal, (2) the septicemic or invasive, and (3) the meningeal. Failure to recognize the signs and symptoms of the second (septicemic or invasive) phase has been a major factor in delayed treatment and the consequent high mortality of these infections.

NASOPHARYNGEAL PHASE

In the nasopharyngeal phase there are usually no signs or symptoms and meningococcic infection cannot be detected except by routine swabbing and culture. The majority of individuals are spared more extensive invasion. Positive carrier rates vary in different epidemics, but Dingle and Finland (3) observed the rate to be 2 to 10 percent in nonepidemic periods. During epidemics the rate may approach 80 percent in apparently healthy troops (4) but a carrier rate in the population of over 20 to 30 percent is highly suggestive of an impending epidemic. Many factors

apparently are operative to determine whether the individual becomes a healthy carrier or succumbs to the further invasion of the meningococcus.

The presence of nasopharyngeal catarrh, with resultant breakdown of local phagocytic barriers in the nose and throat membranes, seems to play a major role in the capacity of the organism to enter the blood stream. Factors in the training life of the individual which tend to alter or lessen his host resistance, such as physical training with attendant fatigue, inoculations, and the development of a more virulent strain of organisms in the nasopharynx, may all be operative in allowing the second phase of meningococcic infection to develop.

INVASIVE OR SEPTICEMIC PHASE

The invasive or septicemic phase represents a definite clinical entity, easy of recognition in most cases. Meningococcic infection is essentially a generalized sepsis, with the infection entering the blood stream via the nasopharynx. Patients sometimes die in this second phase from fulminant overwhelming sepsis, but usually they recover quickly, with or without treatment, or progress rapidly to the meningeal phase. In some instances, however, a period of weeks of chronic fever, chills, sweats and arthralgia occurs until the disease is demonstrated by blood cultures as a chronic meningococcemia.

Most of the fatalities in the age group of recruits will occur from the overwhelming, fulminating cases of septicemia which may terminate fatally before any evidence of the disease in the meninges or spinal fluid is discovered. Delay in instituting treatment leads to increased mortality. It must be said, however, that even with the medical personnel on close guard for meningococcic infections, cases of the overwhelming septic type (Waterhouse-Friderichsen syndrome) will often result in fatalities in spite of prompt recognition and treatment. In these instances, the basic premise of virulence of organism versus immunity of host is apparently so altered that even prompt therapy is futile.

Recognized cases of meningococcemia are becoming more prevalent in recent literature. Daniels, Solomon, and Jaquette (5) in a report of 112 cases of meningococcic infection at Fort Bragg, North Carolina, observed 32 cases without meningitis, and Hill and Lever (6) noted 13 cases with meningococcemia alone in a series of 68 meningococcus infections. Copeman (7) reported 15 cases from the wards of a military hospital in an area in which meningitis was not epidemic. Campbell (8) recently reviewed 88

cases of meningococcemia including 3 of his own, collected from the British and American literature in the past 40 years. These were cases of prolonged or chronic meningococcemia in which meningitis finally developed in 25 instances. They manifested the characteristic signs and symptoms; namely, fever, chills, headache, rash and arthralgia.

The sudden onset of these findings in an individual with the history of a recent or concomitant upper respiratory infection, should immediately suggest a meningococcic infection with blood stream invasion, especially when there is a known epidemic. Although all five of the aforementioned findings may be present at the onset of any acute infection, the characteristic rash is of itself almost pathognomonic of infection by the meningococcus.

The skin manifestations of meningococcemia may be divided into three types, one or all of which may be observed at some time in the same patient. The least common form of the rash in the present series of cases consisted of discrete, pinkish, macular spots varying from pin-head size to $\frac{1}{4}$ -inch in diameter, fading easily on pressure, and usually seen on the lower abdomen, chest, forearms and distal portions of the lower extremities. These lesions may be very evanescent and slightly tender. They are somewhat similar in color to rose-spots of typhoid but are usually much larger and more numerous.

The second and most common type of skin lesion noted was the discrete reddish-purple, petechial spot, not fading on pressure, not tender, and varying in number from a few spots to a great many. These petechial lesions are best observed about the ankles, wrists, flexor surface of the forearms, and on the abdomen but may occur on the mucous or serous membranes. They usually appear during the first 24 hours of the blood stream invasion and vary in size from 1 to 3 millimeters. The lesions gradually fade in the course of a few days and only faint discoloration of the skin persists for a short time.

The third type of rash is seen most characteristically in cases of severe or overwhelming sepsis and consists of purpuric or ecchymotic spots (sugillations) of varying sizes, purplish in color, which may at times become confluent, involving areas several inches in diameter, and progress to purpura fulminans associated with the Waterhouse-Friderichsen syndrome. The intensity and severity of the rash in the cases reported seemed to parallel the gravity of the infection as would be expected in those instances of extreme sepsis. Obviously cases of a severe type may occur with little or no rash, but in my experience these cases have been predominantly meningeal and not septicemic.

Observation of the various types of skin lesions associated with meningococcic infections leads to the belief that these lesions are as diagnostic of meningococcic infections as the rashes of scarlet fever, measles, chickenpox or other exanthemata are specific for those diseases. Former lack of stressing the importance of skin lesions in diagnosis has probably been due to a varying incidence of these lesions being reported in different epidemics and to the possible lessened frequency of skin lesions in sporadic cases.

Underwood (9) states that Rolleston observed 59 percent of cases in World War I as showing skin lesions, and Borovsky recorded only 6.7 percent with skin lesions during the Chicago epidemic in 1930. Smithburn and his coworkers (10) noted petechiae in 68 percent of 144 cases. Strong (11) observed petechiae in 82 percent of 92 cases. While the various types of rashes in meningococcemia may be confused with measles, Rocky Mountain spotted fever, typhus fever, typhoid fever, rheumatic fever, erythema nodosum, purpura simplex or hemorrhagica, or capillary hemangiomata, the history and other clinical findings presented will usually serve easily to differentiate these diseases. The diagnosis of meningococcic infection can and must be arrived at early in the disease by the mode of onset and type of rash, even before the spinal fluid or blood cultures show any abnormalities; a negative fluid may become positive in a few hours and waiting to establish a diagnosis and institute therapy may be disastrous.

In many instances the invasive period of sepsis (blood stream invasion) may be very short and almost nonrecognizable by its merging into the more commonly recognized stage of meningeal invasion. Undoubtedly our ability to diagnose meningococcemia will vary in different epidemics depending upon (1) opportunity to observe cases early, (2) awareness of the significance of early signs and symptoms, (3) the virulence of the infecting strain of meningococcus as related to the host's natural immunity, and (4) the resistance offered at the meningeal barrier, which if very slight, is likely to allow the development of an early meningitis.

INCIDENCE

Public Health Reports show 5,826 cases of meningococcic infections reported in the United States from 10 January to 10 April 1943 as compared with 953 cases in the same period in 1942 and a total case incidence in 1942 of 3,774. During the first world war approximately 6,000 cases were reported in this country with a 40-percent mortality.

TABLE 1.—*Monthly incidence*

1943	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1944	Jan.	Feb.	Total cases
Meningococcemia...	0	0	6	6	7	4	0	0	0	0	0	1	....	0	1	25
Meningitis.....	3	6	16	18	12	9	1	1	2	4	4	11	....	2	2	91
Total.....	3	6	22	24	19	13	1	1	2	4	4	12	....	2	3	116

Observation of the monthly incidence of cases of both meningococcemia and meningitis at this station reveals that it is highest during the winter and spring months, reaching a peak in the months of March, April and May with almost complete cessation of admissions during the summer months of July, August, and September (table 1). This curve of incidence directly parallels the occurrence of respiratory infections, as would be expected.

Comparison of the monthly incidence for 1943 and 1944 is possible at this writing only for the months of January and February when it is essentially the same. March 1944 is not included in this survey but there has been only one admission for meningococcic infection in that month as compared with twenty-two admissions in March 1943. This marked decrease is attributed to a diminished carrier rate for meningococci as a result of the widespread sulfa prophylaxis program instituted in the late fall of 1943.

MENINGOCOCCEMIAS

Analysis of the major clinical findings in the 25 cases of meningococcemias reveals a history of accompanying or preceding upper respiratory infection during the previous 7 to 10 days in 19 cases or 76 percent. Fever, chills, headache and vomiting were almost universally present.

A pathognomonic rash appeared in all 25 cases. In 9 instances it was solely macular in type and in 4 cases it was intensely petechial and associated with purpura fulminans; 2 of the latter patients expired within 24 hours and 2 recovered. These 4 cases are considered instances of the Waterhouse-Friderichsen syndrome. The majority of patients showed the usual petechial type rash already described. Generalized aching, with pains in and around various joints, occurred in 20 instances. The incidence of herpes was low, occurring in only 5 cases.

Three patients in this series had negative spinal fluids on admission, but developed pleocytosis of polymorphonuclear type, with organisms noted by smear and cell counts of 4,000 to 20,000, within 8 to 12 hours. Blood cultures were routinely made on admission and were positive in 9 cases, or 36 percent. Doubt might

be placed on the clinical diagnoses of the remaining cases in this series which were not substantiated by positive bacteriologic proof. However, the mode of onset, character of skin lesions, and presence of an epidemic, together with prompt response to sulfa drugs were considered sufficient to warrant the diagnosis. Particularly was any doubt as to diagnosis dispelled after observing the 3 patients just mentioned, 2 of whom had negative blood cultures and all negative spinal fluids on admission, but with the usual clinical signs and typical rash, developed a positive spinal fluid in only a few hours. Again the great significance of the diagnostic rash in the septicemic phase of meningococcic infection is stressed.

The cases in this series, both meningococcemic and meningitic types, were divided into four grades of severity, using as criteria the mental state on admission, intensity of the rash, evidence of spinal fluid involvement, and fever.

Grade I cases included those patients with evidences of skin lesions of average intensity, associated with a clear mental state and no abnormal spinal fluid findings. This group comprised most meningococcemias except those of the overwhelming septic type. Seventeen of the twenty-five cases came into this category.

Grade II comprised those patients with average intensity of skin lesions (or occasionally none at all on admission), associated with positive spinal fluid evidence of a purulent meningitis, and a dulled or confused sensorium. The three patients having meningococcemia who developed positive spinal fluids shortly after admission were in this group.

Grade III were those patients who had moderately severe skin rashes associated with definite spinal fluid findings and more marked mental changes than those of grade II. None was observed in this series.

Grade IV comprised those patients with severe rashes of purpura fulminans type, associated with evidence of overwhelming sepsis often leading to rapid death in coma and shock.

Of 4 patients in grade IV, 2 recovered and 2 died within a few hours after admission. In the group of 25 patients exhibiting meningococcemia on admission there were 2 deaths, each occurring within 6 hours after entry. Both cases were of grade IV severity and both patients had intense petechial and purpuric skin lesions, low blood pressure, and coma in one instance. Temperatures of 105° F. and 107° F. respectively occurred terminally. Postmortem examination in each instance revealed adrenal lesions consisting of extensive hemorrhagic necrosis. Two other cases were of equal clinical severity as manifested by fever, rash and evidences of shock but the patients recovered.

MENINGITIC TYPES

In the entire group of 91 patients exhibiting meningitis, 60 (67 percent) gave a history of an acute upper respiratory infection existent at the time of entry or during the preceding 7 to 10 days. Symptoms of chills, fever, or vomiting were practically universal.

The high incidence of skin lesions in 71 cases (78.5 percent) points to its importance as a diagnostic feature. The rash was of a petechial character in almost all instances with only 2 patients exhibiting a combination of macular and petechial types. In 3 instances, the rash was intense with widespread petechiae associated with lesions of extensive purpura. Death resulted in 2 instances of this type of rash with recovery in 1 case, indicating the importance of the intensity of skin lesions as a guide to prognosis.

A history of joint aches or pain occurred in 52 cases (57 percent) but the occurrence of actual swollen tender joints on admission or during the course of the illness was quite low. Herpes occurred in 29 instances (32 percent).

The clinical severity of meningitis cases was graded as for meningococcemia. There was no case in grade I, 41 were rated grade II, 46 grade III, and 4 grade IV in severity.

Leukocyte counts on admission ranged from 7,800 to 55,400, averaging about 27,500. However, in one grade III case with a positive blood culture there was a white blood cell count of only 9,750 on admission, and in one of grade II severity with a positive spinal fluid, an admission count of only 7,800 white blood cells.

Spinal fluid counts ranged from 30 cells in one patient to 83,000 in another who expired untreated. The highest cell count in a recovered patient was 53,600. Spinal taps were not repeated after the initial tap except in rare instances to denote progress of the disease, particularly as regards incidence of organisms, for relief of severe headaches, and as a routine measure at the end of 2 weeks prior to release from isolation. In view of the uniform normalcy of the fluid at the end of 2 weeks, it is felt that this final tap is hardly necessary.

Positive spinal fluids for gram-negative diplococci were found in 68 cases. In 21 no organisms were found, either by blood culture or by spinal fluid examination prior to intensive treatment, but cytology of the spinal fluid, presence of typical rash and symptoms, and no clinical evidence of any other bacteriologic type of purulent meningitis, was considered proof of true meningococcic infection. In 2 instances blood cultures were positive for meningococci, but no organisms were found in the spinal fluid despite a high cell count.

TABLE 2.—*Therapy in meningococcemia cases*

Grade	Oral sulfanilamide and sulfanilamide by clyses	Oral sulfadiazine	Oral sulfadiazine and parenteral sod. sulfadiazine	Oral sulfadiazine and sulfanilamide by clyses	Oral sulfadiazine and parenteral sod. sulfadiazine and antitoxin I. V.
I.....	1	11	3	2	
II.....		1			3
III.....					
IV.....	1—No specific therapy. Died within 2 hours after admission.		1—Died within 8 hours after admission.		2

TREATMENT

In no other acute bacterial infection has chemotherapy produced more striking results than in the field of meningococcic infections. Not only has there been a tremendous reduction in mortality rates, but the entire clinical course of the disease has been altered, as evidenced by shortening of the period of active infection and the convalescent time and almost complete freedom from distressing complications or relapses. It must be borne in mind, however, that in military life we are dealing largely with the age group of 18 to 25 when the chances for recovery are the most favorable of any age group, regardless of the treatment used.

Because of variation in the stock of sulfa drugs at this hospital shortly after its commissioning, of necessity routine employment of any one preparation was impossible. This afforded opportunity to compare results of treatment with various sulfonamides.

Opportunity to observe the combined effects of antitoxin serum and chemotherapy was afforded in the earlier cases. Because of the frequency of serum reactions of an unpleasant, though not alarming nature, and numerous reports of good results from chemotherapy alone, the use of serum was discontinued with no perceptible changes in the therapeutic results. Sulfadiazine was used exclusively in the later cases.

In general, the cases of meningococcemia were of grade-I severity; the patients were fully conscious, and able to take medication orally, retaining sufficient amounts despite instances of vomiting. The usual plan in these cases was to administer a sulfa drug in dosages of $1\frac{1}{2}$ to 2 grains per pound of body weight each 24 hours, combining it with clysis of sulfa drugs if vomiting or dehydration was evident. Fluids by mouth or parenterally, sufficient to secure 1,200 to 1,500 cc. of urinary output daily were given. Usually 12 to 15 gm. of a sulfa drug were administered in the first 24 hours in these cases and reduced to 8 gm. daily until the temperature remained normal for 2 or 3 days. The dosage was then

TABLE 3.—*Therapy in meningitis cases*

Grade	Oral sulfadiazine plus sulfanilamide intravenously	Oral sulfadiazine	Oral sulfadiazine plus sodium sulfadiazine intravenously	Oral sulfadiazine plus sodium sulfadiazine plus clyses of sulfanilamide	Oral sulfadiazine plus sodium sulfadiazine plus sulfanilamide by clyses plus antitoxin 40,000 units intravenously	Sulfanilamide orally, sulfanilamide intravenously and by clyses plus antitoxin	Oral sulfadiazine and intravenous sodium sulfadiazine plus antitoxin 40,000 units intravenously	Oral sulfanilamide plus antitoxin	Sulfadiazine orally plus sulfanilamide intravenously and by clyses plus antitoxin 40,000 units intravenously
I.	1	3	9	1	1	3	18	2	2
II.	1	2	18	3	1	4	7	1	4
III.	1		1 recovery after treatment		5				
IV.	1 died, no treatment		1 died 22 hrs. after treatment		1 died after 3 days' treatment (80,000 units antitoxin)				

tapered down gradually but was usually maintained at 4 to 6 gm. daily for 10 to 14 days before complete cessation. The treatment utilized in cases of meningococcemia and those of meningitis of varying degrees of severity is shown in tables 2 and 3.

SUMMARY OF TREATMENT OF MENINGITIS CASES CHEMOTHERAPY ALONE

- 29 patients received intravenous sodium sulfadiazine and clyses of sodium sulfadiazine and oral sulfadiazine.
- 5 patients received intravenous sodium sulfadiazine and oral sulfadiazine.
- 3 patients received intravenous sodium sulfadiazine, clyses of sulfanilamide and oral sulfadiazine.
- 1 patient received oral sulfadiazine only.
- 1 patient received intravenous sulfanilamide and oral sulfadiazine.

39

CHEMOTHERAPY PLUS ANTITOXIN

- 25 patients received intravenous sodium sulfadiazine, oral sulfadiazine and antitoxin.
- 7 patients received intravenous sodium sulfadiazine, oral sulfadiazine, sulfanilamide by clyses and antitoxin.
- 7 patients received intravenous sulfanilamide, sulfanilamide by clyses, oral sulfanilamide and antitoxin.
- 6 patients received oral sulfanilamide and antitoxin.
- 6 patients received intravenous sulfanilamide, sulfanilamide by clyses, oral sulfadiazine and antitoxin.

51

- 1 patient received no treatment whatsoever.
- Total cases: 91

PRESENT ROUTINE FOR DIAGNOSIS AND TREATMENT OF MENINGOCOCCIC INFECTIONS

1. Immediate spinal tap with examination of fluid for white blood cells, doing a differential count, a Pandy, a smear and a culture.
2. Spinal tap repeated in 8 to 12 hours if petechial rash or meningeal signs persist, even though the initial tap was negative.
3. Blood culture on admission before any therapy is given. Routine leukocyte count and differential.
4. Immediate intravenous administration of sodium sulfadiazine, 5 gm. in 100 to 200 cc. of distilled water.

TABLE 4.—*Complications*

Complication	Number of cases	Involvement
Arthritis.....	2.....	Left knee
	1.....	Both knees and elbows
	1.....	Right ankle
Cranial nerve defects.....	1.....	Seventh nerve weakness (disappeared in 2 weeks)
	1.....	Diplopia (appeared on tenth day; lasted 1 week)
Aphasia ¹	1.....	
Pneumonia.....	1.....	
Required catheterisation.....	12.....	
Reactions from antitoxin.....	27.....	
	4.....	Rash
Reactions from sulfa drug.....	3.....	Hematuria
	2.....	Bone marrow depression

¹ This patient was very ill with a spinal fluid cell count of 53,600 leukocytes on admission and was totally unconscious for 3 days. He was discharged well after 3 months.

5. Oral administration of 30 grains of sodium sulfadiazine as an initial dose followed by 15 grains every 3 hours if the patient is conscious and not vomiting.

6. If the patient is unconscious, is vomiting, or has severe rash, the intravenous sulfadiazine is supplemented by clyses of the same drug, 5 gm. (0.5 percent) in 1,000 cc. of Hartmann's solution. Clysis is repeated every 8 to 12 hours for the first 24 hours. The total sulfa dosage in the first 24 hours is based on at least 2 to 2½ grains per pound of body weight.

7. Intravenous sulfadiazine is not repeated after the initial dose. A blood level of 15 to 20 mg. is maintained by daily clyses until the patient can tolerate the drug orally.

8. Sulfa therapy is continued for 10 to 12 days in gradually diminishing doses after the temperature has become normal.

9. Close observation of the daily urinary output is maintained, securing an output of 1,200 to 1,500 cc. daily. Complete blood counts are done at least twice weekly and blood pressure is taken every few hours in patients who have a severe rash.

10. One-sixth grain of morphine alone or combined with two grains of sodium luminal by hypodermic injection is given as needed for headache or extreme restlessness.

11. The patient is watched carefully for bladder distention.

12. Spinal tap is repeated on the fourteenth hospital day and the patient is not released from isolation until two negative nose and throat cultures have been secured.

This routine has been carried out in practically every case in this series during the past six or seven months. That it affords adequate sulfa levels is attested by the fact that blood levels secured at the end of 24 hours in these cases showed results of 18 to 22 mg. per 100 cc. In one instance a level of 40 mg. per 100 cc. of blood was reached without any harmful effects. Perhaps

TABLE 5.—*Mortality*

	Total cases	Deaths	
		Treated	Untreated ¹
Meningococcemia.....	25	0	2
Meningococcic meningitis.....	91	2	1
Mortality rate.....		1.72%	2.59%
	116	5	4.31%

¹ Died within 24 hours.

equally good results would be obtained from lower levels, but in view of the known individual variations in rapidity of excretion, general acceptance of early intensive treatment, and no serious ill effects noted from these levels, it would seem that the results of such treatment in the present series warrant its continued usage.

Serum antitoxin seems to occupy no further favored place in treatment of meningococcic infections. The rare case known to be sulfa-resistant might be benefited by its use, but penicillin would probably be the treatment of choice in such a situation.

In arriving at the mortality rates in this series of meningococcic infections it is felt that deaths occurring within 24 hours should be considered as having occurred too early to note the effect of any therapy. If these cases are excluded, and it seems only fair to do so in evaluating therapy, then only two deaths occurred in patients treated over 24 hours, resulting in a corrected mortality rate of 1.72 percent for all treated meningococcic infections.

Of the two fatal cases afforded intensive treatment worthy of therapeutic evaluation, one death occurred at the end of 24 hours in a patient ill for 1 month with acute rheumatic fever who suddenly developed a Waterhouse-Friderichsen syndrome, exhibiting extensive purpura fulminans and shock, and adrenal hemorrhage at autopsy. The other fatality occurred in a patient treated for 3 days. Necropsy showed an extensive suppurative frontal sinusitis with extension into the dura. The existence of this suppurative focus with direct continuity with the intracranial cavity was capable of affording too overwhelming an infection for cure.

The third fatal case of meningitis was in a patient who received no therapy whatsoever, having been admitted on a catarrhal fever ward, and the diagnosis not being suspected until very shortly before death.

Fatalities in two cases of meningococcemia were examples of the Waterhouse-Friderichsen syndrome confirmed at autopsy, with death occurring 2 and 8 hours respectively after admission.

SUMMARY AND CONCLUSIONS

1. One hundred sixteen cases of meningococcic infections occurring at a Naval hospital are presented, with analysis of the salient features in diagnosis and treatment. Twenty-five cases, or 21.5 percent, were considered clinical instances of the bacteriemic phase of the disease.

2. Meningococcus infections are often purely septicemic in character, with the development of meningitis only one phase of such infections.

3. The cardinal manifestations of fever, chills, headache, characteristic rash, and arthralgia, in the presence of an epidemic, are sufficient to warrant the diagnosis of a meningococcic infection and to require early institution of treatment while awaiting laboratory confirmation. Failure to recognize meningococcic infections in the septicemic phase leads to unnecessary delay in instituting proper treatment.

4. The mortality rate seems to parallel the intensity and severity of the skin lesions.

5. Evidence of adrenal damage with vascular failure must be carefully watched for, particularly in patients with extreme skin manifestations of the purpura fulminans or intense petechial types. Prognosis in such cases, while always grave, is not hopeless if early intensive treatment is instituted.

6. A total mortality rate of 4.3 percent occurred for all cases, treated or untreated, with a corrected rate of 1.72 percent for cases treated for at least 24 hours.

7. No evidence was obtained in this series of meningococcic infections to warrant further employment of antitoxin in the plan of treatment.

8. Early diagnosis with prompt institution of chemotherapy, preferably by the parenteral route, maintaining a high concentration of the drug in the blood and spinal fluid, leads to rapid control of the infection and ultimate complete recovery in over 98 percent of meningococcic infections.

REFERENCES

1. HERRICK, W. W.: Cerebrospinal meningitis. J.A.M.A. 71: 612-617, August 24, 1918.
2. GWYN, N. B.: Bull. Johns Hopkins Hosp. 10: 110, 1899.
3. DINGLE, J. H., and FINLAND, M.: Diagnosis, treatment and prevention of meningococcic meningitis with résumé of practical aspects of treatment of other acute bacterial meningitides. War Med. 2: 1-58, January 1942.
4. CHEEVER, F. S.; BREESE, B. B.; and UPHAM, H. C.: Treatment of meningococcus carriers with sulfadiazine. Ann. Int. Med. 19: 602-608, October 1943.

5. DANIELS, W. B.; SOLOMON, S.; and JAQUETTE, W. A., JR.: Meningococcic infection in soldiers. *J.A.M.A.* 123: 1-9, September 4, 1943.
6. HILL, L. W., and LEVER, H. S.: Meningococcic infection in Army camp. *J.A.M.A.* 123: 9-13, September 4, 1943.
7. COPEMAN, W. S. C.: Meningococcal septicaemia. *Brit. M. J.* 1: 760-761, June 20, 1942.
8. CAMPBELL, E. P.: Meningococcemia. *Am. J. M. Sc.* 206: 566-576, November 1943.
9. UNDERWOOD, E. A.: Recent knowledge of incidence and control of cerebrospinal fever. *Brit. M. J.* 1: 757-763, May 11, 1940.
10. SMITHBURN, K. C.; KEMPF, G. F.; ZERFAS, L. G.; and GILMAN, L. H.: Meningococcic meningitis; clinical study of 144 epidemic cases. *J.A.M.A.* 95: 776-780, September 13, 1930.
11. STRONG, P. S.: Recognition of meningococcic infections. *Am. J. M. Sc.* 206: 561-566, November 1943.



CARE OF THE UNCONSCIOUS PATIENT

Respiratory obstruction is the immediate cause of death in an appalling number of unconscious or semiconscious subjects.

The most common form of respiratory obstruction occurs in the upper tract and is caused by relaxation of the muscles of the tongue and pharynx allowing the soft parts to fall back into the posterior pharynx. Prevention of this type of obstruction is simple; if the mandible is raised and brought forward, the tongue and soft parts are displaced away from the posterior pharynx.

The next most common form of respiratory obstruction in the upper tract is the collection of secretions—mucus, blood, vomitus, etc. The protective mechanisms such as expectorating, swallowing or coughing are lost in the rugged or injured unconscious subject. Ideally, aspiration of this foreign material is desirable if the patient is in the supine position.

Actually, however, apparatus to accomplish this purpose is rarely if ever immediately available and the time lost in obtaining it, even though it is within reaching distance, may cost the life of the patient. Wiping the material out with the finger covered with gauze is advisable, but in most instances not completely effective.

Practically, the patient can be placed immediately in the Trendelenburg position so that the material will drain into his nasopharynx, or he may be rolled onto his abdomen, or he may be put in the so-called "Sims," "tonsil" or "cerebellar" position in which with a minimum amount of adjustment, the airway may be cleared and kept clear by gravity.—HATHAWAY, H. R.: Immediate care of unconscious patient. *J. Nerv. & Ment. Dis.* 99: 636-639, May 1944.

EPIDEMIC DIAPHRAGMATIC PLEURODYNIA

AN OUTBREAK

WALTER S. McDANIEL

Lieutenant Commander (MC) U.S.N.R.

About 15 February 1944 on this small, barren Caribbean island there occurred the first case of what later turned out to be a small epidemic of an unusual and interesting disease. The symptomatology and course of all cases were remarkably similar with only a few individual variations. There were 25 cases observed at 3 different military stations, two-thirds of which occurred in officers.

The presenting symptom was a pain of varying intensity located usually anteriorly and closely following the lower rib margins at the level of the insertion of the diaphragm. The pain was of a deep, aching, steady type which caused great difficulty in breathing and forced the subject to adopt a peculiar hunched-over posture. This condition was usually preceded by prodromal malaise lasting about 24 hours. Accompanying the pain in practically all cases was a fever ranging from 99° to 102° F. This febrile period rarely lasted over 48 hours and dropped rapidly to normal. The pulse was relatively slow, never getting above 100. Respirations were not increased but were shallow and spasmodic due to the pain. Frontal headache was present in approximately half the cases as was a slight general muscular aching. In no case was there any sign of upper respiratory disease.

In one-third, the condition would apparently completely subside for one or two days only to begin again with equal intensity and show all indications of a definite relapse. Three patients had two relapses after the initial onset, leaving them with residual deep mild aching in the region of the diaphragm for several days. The distribution of the pain varied to some extent, usually starting as has been described but later extending around to the back and upward over the anterior part of the chest and shoulders. Practically all patients had shoulder pain at one time or another. The chest and shoulder pain was not increased on movement, except on breathing, nor could any tenderness on pressure be elicited. After the first 24 hours, the pain would continue even though the temperature would drop to normal.

Laboratory facilities being limited, the work-up of these cases consisted of routine blood counts and urinalyses, the results of which were negative. The white blood cell count ranged from

4,000 to 8,000 which was of some diagnostic importance in ruling out certain other conditions. Flat plate x-ray examination of the chest was made on 4 of the more severely ill patients who were hospitalized, but no evidence of pathologic changes was revealed.

The picture was so typical after the first few cases that there was no difficulty in making a diagnosis which was made by elimination, only a few other conditions being considered. The question of trichinosis was eliminated by the absence of eosinophils and gastro-intestinal upsets.

In one case a tentative diagnosis of coronary occlusion was made by a medical officer who did not know of the epidemic. The pain in this case was in the upper chest extending outward, and the next day it was localized in both shoulders. There was fever, normal blood count and no evidence of heart disease.

The method of transmission remains unknown. There was no evidence to incriminate food or water supply. Many of the patients lived in the same or adjoining barracks, and it can only be said that some form of contact must have been the means of contagion.

Treatment was entirely symptomatic, and since the disease was of such short duration, bed rest, codeine and acetylsalicylic acid were sufficient to make most of the patients comfortable.

As far as can be determined from the literature, no cases of epidemic diaphragmatic pleurodynia have ever come to autopsy, and the mortality is apparently zero. The pathosis, therefore, remains unknown, but from the very definite symptoms involved it can be postulated that there must be an inflammatory involvement of the diaphragmatic pleura or the muscle of the diaphragm with subsequent spread in many cases to other areas of pleura or the intercostal muscles. Involvement of the central portion of the diaphragm and its pleura can be considered definite because of the referred shoulder pain in almost all cases. This is the typical referred area of the sensory portion of the phrenic nerves. The pain so frequently complained of around the lower thorax is probably due to stimulation of the sensory fibers of the fifth and sixth intercostal nerves which supply the peripheral diaphragmatic areas.

COLLAPSE OF INTERVERTEBRAL DISC FOLLOWING SPINAL PUNCTURE

REPORT OF TWO CASES

F. HAROLD DOWNING
Commander (MC) U.S.N.R.

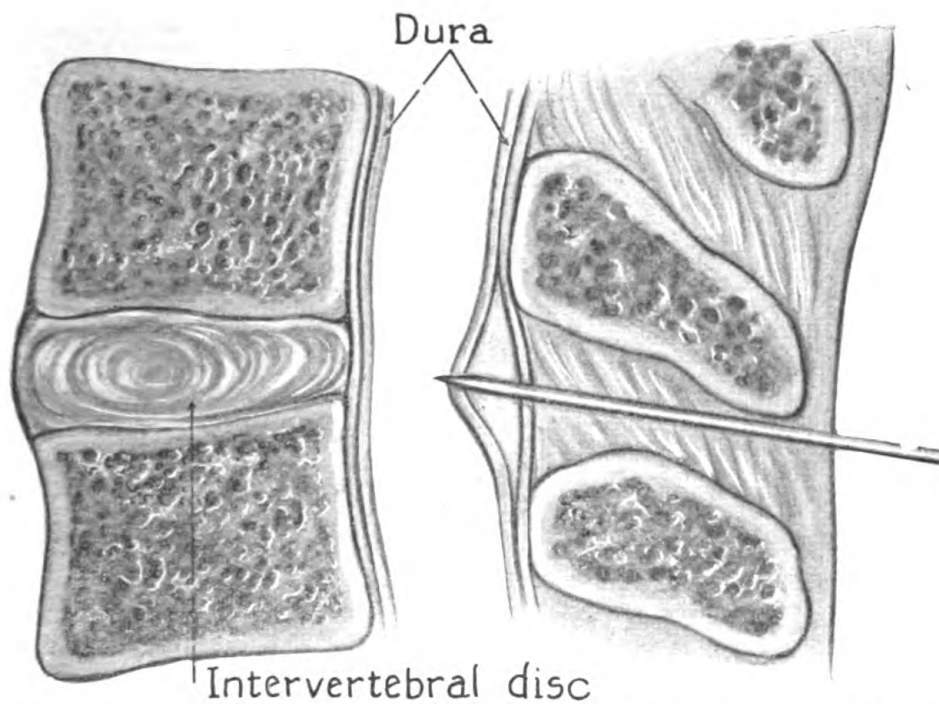
Although several cases have been reported of injury to the intervertebral disc by lumbar puncture, followed by persistent back pain and showing x-ray evidence of a collapse of the disc, the direct relationship still remains in dispute.

In 1919 Levinson (1) stated that the spinal puncture needle may be inserted too far and that in this event the lumen might become clogged from the nuclear material, which would account for failure to obtain spinal fluid. Pease (2) in experimental lumbar punctures on cadavers, found that it was not always possible to determine when the point of the needle entered the neural canal, passed it, or entered the intervertebral disc.

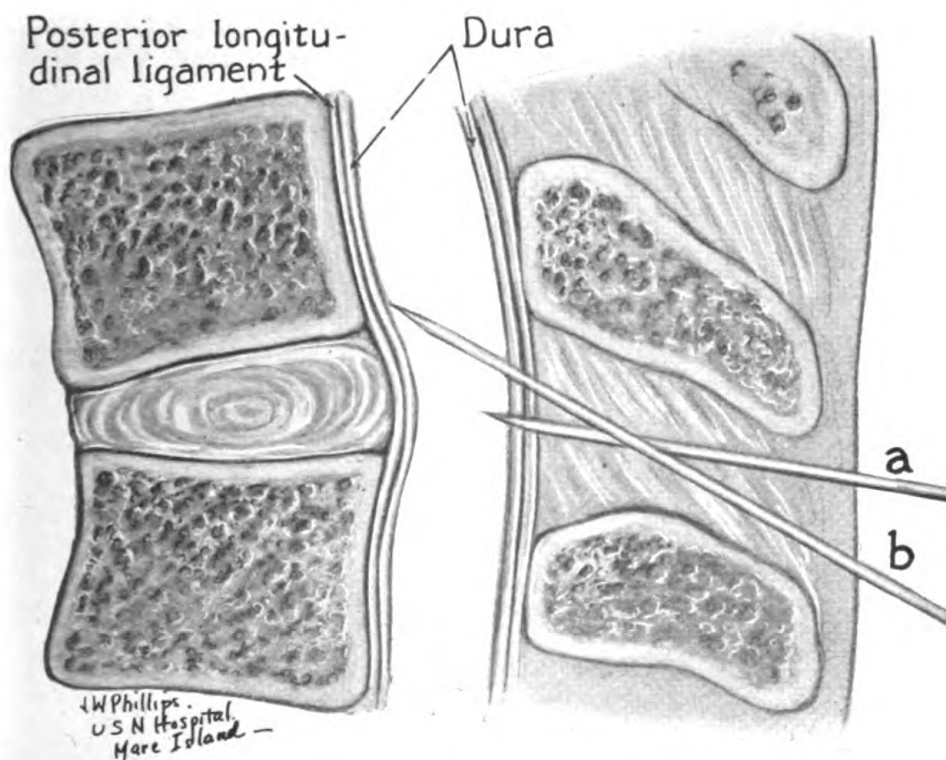
Munro and Harding in using the two-needle technic in myelography allowed the needles to remain in place while lateral x-ray views of the spine were made. They found that of the 50 needles inserted, 36 percent were in such position that, had they been inserted farther in their course, they would have penetrated the annulus fibrosus. The average distance between the point of the needle and the annulus was from 4 to 5 mm. They explained the penetration of the needle beyond the anterior dura by a pushing of the arachnoid ahead of the point of the needle (fig. 1).

Pease also demonstrated that when the torso is flexed in preparation for a lumbar puncture, and the needle is inserted in the midline beyond the neural canal, it will enter the intervertebral disc. If the body is not flexed, the needle will strike the vertebral body or enter the venous sinusoid or one of the connecting veins (fig. 2, a and b). Flexion of the spine increases the intradisc pressure, and because of the stronger anterior elements of the disc, this pressure is reflected in the weaker posterior portion, causing a slight bulging of the disc into the neural canal. The needle, in entering the disc, allows the nuclear material to escape into the lumen of, or around the needle.

Experimental studies by Keyes and Compere (3) led them to conclude that a very minor puncture of the intervertebral disc might result in the escape of nuclear material, in back pain and disability, partial collapse of the disc and marginal proliferation



1. The dura may be pushed ahead of the spinal puncture needle before it is finally penetrated.



2. When the spine is flexed there is a slight bulging of the disc into the neural canal. If the needle is directed cephalad and is inserted too far, it will not be in line with the disc as in (a) but will strike the posterior surface of the vertebral body as in (b).

of the adjacent vertebral bodies. Subsequent reports by Milward and Grout (4), Gellman (5) and others (6) substantiate these observations.

In the two cases to be reported here collapse of the intervertebral disc followed operations in which a spinal anesthetic was employed. Both had the onset of back symptoms and disability shortly following operation, and, in both subsequent x-ray studies showed partial collapse of the intervertebral disc between the third and fourth lumbar vertebrae.

CASE REPORTS

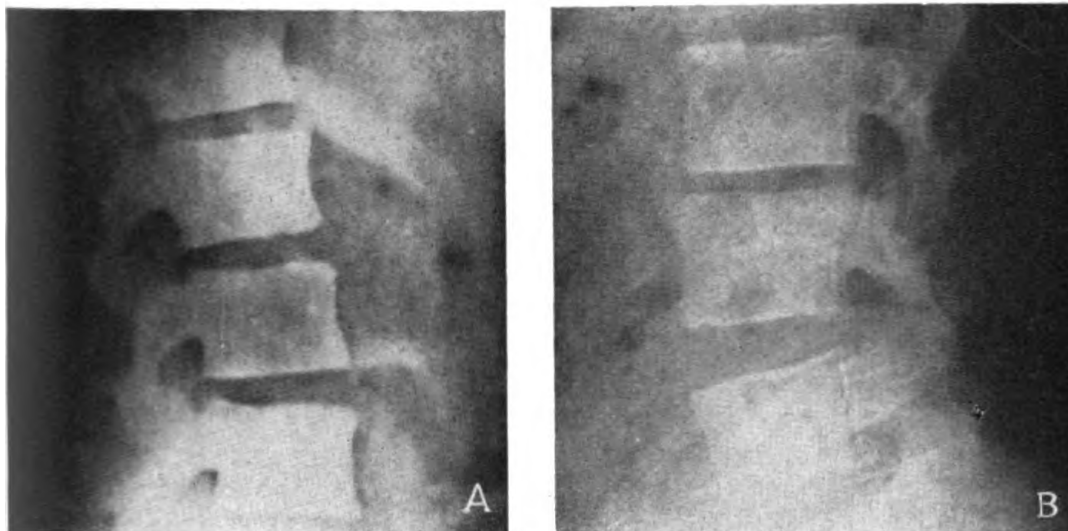
Case 1.—An electrician's mate, third class, 19 years old, was operated upon for an acute appendicitis on 19 May 1943 at a South Pacific island hospital. A spinal anesthetic was employed. He noticed the onset of pain in his back the day following operation. This pain persisted for one week and required the administration of codeine. When he was allowed up on the sixth post-operative day, he was stooped over and could not stand erect. The back pain was confined to the lower lumbar region and radiated to the left hip and down the anterior aspect of the left thigh to the knee.

The pain gradually subsided and the patient was able to return to his regular duties on the twelfth postoperative day, free of any back complaint. One week after returning to duty he helped pass ammunition weighing about thirty-five pounds with no back discomfort. Three weeks after returning to duty he had a gradual onset of back pain which was confined to the lower lumbar region but did not radiate; it compelled him to walk with his back hyperextended. His duties were then modified to require only standing or sitting, but his symptoms increased in severity and soon forced his hospitalization.

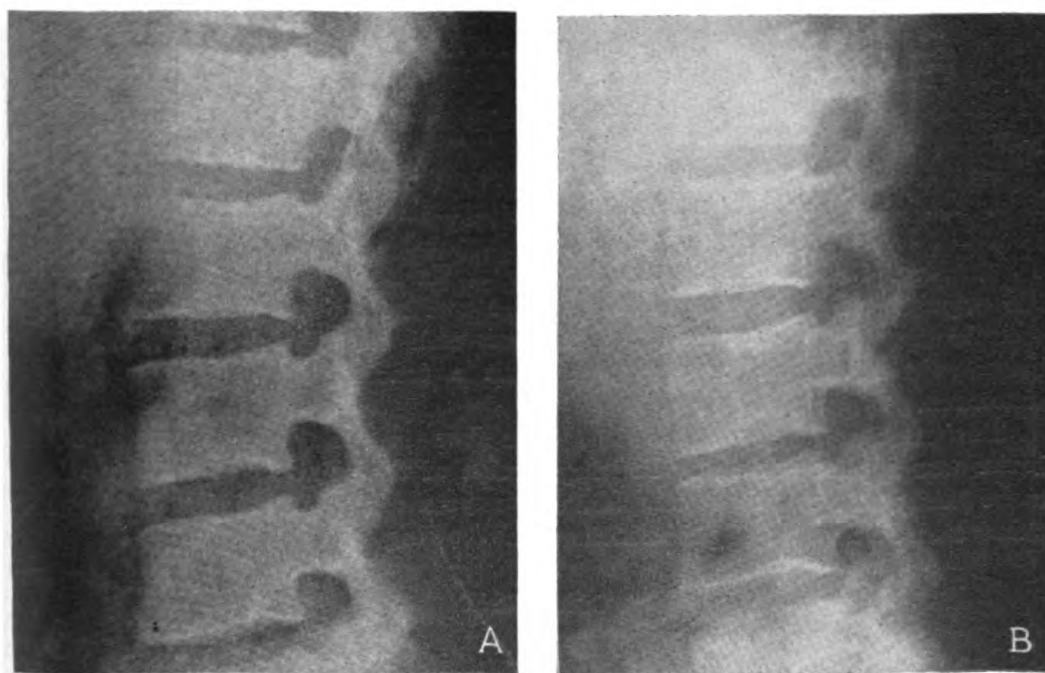
X-rays of the spine taken on 31 July did not show any abnormalities (fig. 3a). After a month of hospitalization, no marked improvement was shown and the patient was evacuated to the United States as an ambulatory patient. On 31 October he was admitted to this hospital still complaining of persistent back pain.

Examination revealed moderate localized tenderness over the third and fourth lumbar spinous processes, lower lumbar muscular tenderness with muscle spasm, and limitation of motion of the spine in all directions, especially forward bending. All passive motions of the spine were painful beyond the free range. There were no pathologic leg signs or sensory changes and all reflexes were normal. X-ray studies of the lumbar spine on 3 November revealed a narrowing of the intervertebral space of the third and fourth lumbar vertebrae associated with calcification bridging the anterior aspect of the interspace (fig. 3b).

On 18 November a hyperextension plaster jacket was applied and the patient was directed to remain in bed except for lavatory privileges. After 3 months the jacket was removed and a Taylor spinal brace applied. Despite this extensive treatment, the patient felt that there had been only slight improvement in his back symptoms and that the brace was helpful only in that it prevented him from stooping and thus aggravating his pain. There had been no appreciable change in the x-ray findings. A spinal fusion was considered, but it was decided to give him a test of limited duty first.



3. Lateral views of the lumbar spine in case 1. **A.** Taken 10 weeks after lumbar puncture. No narrowing of the disc is seen in this film. **B.** Taken 5½ months after lumbar puncture shows definite collapse of the disc between the third and fourth lumbar vertebrae with productive bone changes anteriorly.



4. Lateral views of the lumbar spine in case 2. **A.** Taken 3 weeks after lumbar puncture shows normal width of the intervertebral disc. **B.** Taken 5 weeks after lumbar puncture shows definite collapse of the disc between the third and fourth lumbar vertebrae.

Case 2.—A seaman, first class, 20 years old, was admitted to this hospital on 11 November 1943 because of a periproctal abscess. On 1 December, using 100-mg. procaine as a spinal anesthetic, a small fistula in ano was excised.

Postoperative convalescence was uneventful and the patient was allowed up after 1 week of bed rest during which time he had no symptoms referable to his back. When he got out of bed for the first time he noticed that he could not bend over because of pain and stiffness in his back. After walking around for a while the back pain wore off. After lying down and then trying to get up, the back would again become stiff and painful. One week later his symptoms became so severe that he was compelled to remain flat in bed. There was no radiating pain to the legs but certain motions of the spine caused severe cramp-like pains in the low back, radiating to the hips, chiefly to the right hip.

Examination revealed very marked lumbar muscle spasm with pain on all active and passive motions of the spine, inability to bend forward and localized tenderness over the spinous processes of the third and fourth lumbar vertebrae with associated lower lumbar muscular tenderness. There were no sensory changes in the extremities, and except for a suggestive positive Oppenheimer and Babinski on the right, the reflexes were normal. X-ray examinations of the spine on 21 December showed no evidence of bone or joint disease (fig. 4a).

The orthopedic surgeon consulted on 24 December considered the patient's complaints to be due to an injury to the intervertebral disc following lumbar puncture. The anesthetist recalled that the spinal puncture had been performed with the patient in the sitting position on the fourth attempt, and that bloody fluid was obtained; that a satisfactory anesthesia was secured but was associated with a greater than usual blood pressure drop.

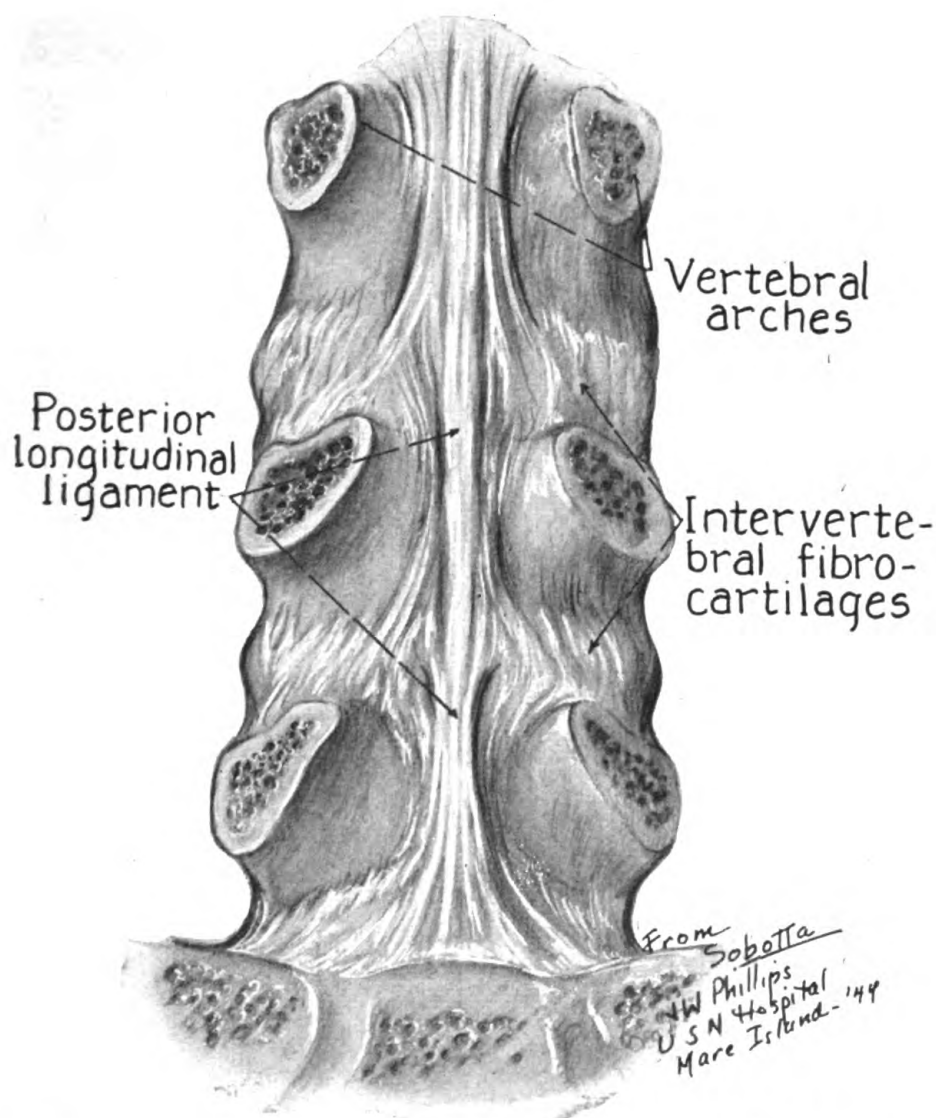
X-ray studies of the lumbar spine on 6 January 1944 showed a definite decrease of the intervertebral space between the third and fourth lumbar vertebrae (fig. 4b). The neurologist consulted did not believe it possible for a lumbar puncture to cause this collapse of the intervertebral disc as shown in the x-ray and presumed the rupture had been in some direction other than posterolateral.

On 15 January a hyperextension plaster jacket was applied and 4 days later the patient's back pain completely subsided. He remained in bed for the first 3 weeks after the jacket was applied and then gradually became ambulatory. There was no reappearance of his back pain despite increase in his physical activity. The plaster jacket was removed after 3 months and examination then showed that there was still considerable restriction and some pain on flexion of the spine with a tendency to hold the back in extension.

Side bending and hyperextension were free and painless. A Taylor spinal brace was applied which, by limiting flexion of the spine, enabled the patient to be fairly active without complaint. X-rays made on 16 March showed that there had been some slight additional narrowing of the intervertebral disc.

COMMENT

The posterior longitudinal ligament in the lumbar segments becomes narrowed and thus only reinforces the annulus fibrosus in its posterior portion in a very small area (fig. 5). The author is of the opinion that when the needle point becomes deflected to



5. Posterior view of the neural canal. The posterior longitudinal ligament reinforces the annulus fibrosus in only a very narrow area in the midline.

either side of the midline, it may be deflected past the dura without penetrating it, and the operator, not obtaining the spinal fluid, continues to advance the needle until finally the annulus fibrosus and the intervertebral disc are penetrated lateral to the posterior longitudinal ligament. If this is repeated, several punctures of the annulus will occur in its weakest area; the damage may be sufficient to allow the subsequent escape of nuclear material or to precipitate traumatic degenerative changes which finally result in intervertebral disc collapse.

In the first case reported here, the onset of early symptoms together with long-delayed evidence of intervertebral disc collapse would indicate that the pain was more likely due to extensive disc

trauma rather than the subsequent escape of nuclear substance. The resultant collapse of the disc was purely a later degenerative reaction precipitated by the original trauma; it was also manifested by productive osteo-arthritic changes. It is likewise possible that the further productive bone changes are the result of a protective reaction from an altered mechanical condition producing abnormal stress and strain. This theory would also account for the chronicity of the symptoms and the failure to obtain relief by mechanical supportive treatment.

In the second case, however, the symptoms appeared later and not until the weight-bearing had been reestablished. The collapse occurred in a period known to be not more than 16 days. This is too short a period to be explained by degenerative changes and can only be explained by a rapid change in the intradisc pressure which would occur with an escape of nuclear material. As it was known in this case that 3 unsuccessful attempts were made to obtain spinal fluid at the third and fourth lumbar interspace, 3 or more punctures of the annulus fibrosus in this region were possible. They could have occurred in its weakest portion, lateral to the posterior longitudinal ligament, and the damage produced could have been sufficient to allow the gradual escape of hydrostatic nuclear substance. Back symptoms originated when the process of adjustment was precipitated and were relieved by mechanical support.

CONCLUSIONS

The occurrence of two nearly identical cases, giving similar physical and roentgenographic findings and presenting a collapse of the intervertebral disc between the third and fourth lumbar interspace, which in each case occurred after a spinal anesthetic had been employed, is considered evidence that a direct relationship exists between spinal puncture and intervertebral disc collapse.

The acutely flexed position of the spine when the puncture is made increases the danger of injury to the disc by increasing the intradisc pressure and directing the needle toward the intervertebral space.

The needle should be angulated cephalad so that in case it is inserted too deeply, it will strike the posterior surface of the superior vertebra.

The need for the use of a sharp, fine-caliber, short-bevel needle and extremely careful technic is apparent.

REFERENCES

1. LEVINSON, A.: Cerebrospinal Fluid in Health and in Disease. The C. V. Mosby Co., St. Louis, 1919.
2. PEASE, C. N.: Injuries to vertebrae and intervertebral disks following lumbar puncture. *Am. J. Dis. Child.* 49: 849-860, April 1935.
3. KEYES, D. C., and COMPERE, E. L.: Normal and pathological physiology of nucleus pulposus of intervertebral disc; anatomical, clinical and experimental study. *J. Bone & Joint Surg.* 14: 897-938, October 1932.
4. MILWARD, F. J., and GROUT, J. L. A.: Changes in intervertebral discs following lumbar puncture. *Lancet* 2: 183-185, July 25, 1936.
5. GELLMAN, M.: Injury to intervertebral discs during spinal puncture. *J. Bone & Joint Surg.* 22: 980-985, October 1940.
6. STUMP, J. P., and NARINS, S. A.: Intervertebral disc injury during spinal puncture. *U. S. Nav. M. Bull.* 41: 400-403, March 1943.

PENICILLIN-FAST *TREPONEMA PALLIDUM*

Intratesticular inoculations in rabbits were made with suspensions of the popliteal lymph nodes of rabbits which had been infected intracutaneously with *T. pallidum* and then treated with varying amounts of penicillin. From two of the rabbits which had developed skin chancres, spirochetes were isolated by this means. After one intratesticular passage, *in vitro* tests were performed to determine whether any change had occurred in the resistance of the spirochetes to penicillin.

The spirochetes derived from the rabbit with the large chancre showed no difference from the parent strain in their susceptibility to penicillin. Those derived from the rabbit with the abortive lesion were distinctly more resistant to the action of penicillin than the parent strain. This characteristic has persisted after further intratesticular passages.

Sufficient treatment with penicillin to modify the course of an experimental syphilitic infection, but not enough to cure the animal, resulted in the development of a penicillin-fast strain. This emphasizes the necessity for adequate treatment with penicillin in clinical cases.—DUNHAM, W. B.; HAMRE, D. M.; and RAKE, G.: Development of penicillin-fast strain of *Treponema pallidum*. Abstracted in *J. Bact.* 47: 428, May 1944.

FATIGUE-STRESS FRACTURES

**DIVERSE ANATOMIC LOCATION AND SIMILARITY
TO MALIGNANT LESIONS**

J. GERSHON-COHEN

Lieutenant Commander (MC) U.S.N.R.

and

ROBERT E. DORAN

Lieutenant Commander (MC) U.S.N.R.

The most common type of fatigue-stress fracture is that which occurs in the second and third metatarsals, usually referred to as a march fracture. Similar fractures in other bones have been reported under various names such as occult fracture, insufficiency fracture, overload fracture, wear and tear fracture, recruits' disease, periostitis ab exercitio, osteopathia itineraria tibiae, soldiers' fracture, spontaneous fracture, pseudofracture, insidious fracture and creeping fracture. Some of these terms are very descriptive, but because all these fractures occur in normal bone in the absence of systemic disease, Hartley's terms "fatigue" or "stress" fracture seem most appropriate.

Hartley (1) likens these fractures to those which occur in metals. Henschen, Straumann and Bucher (2), using spectro-radiographic methods, have shown that in bone under duress, exhaustion fracture does occur if the rest period is inadequate exactly as fractures develop in overstressed metals. Hartley illustrated this mechanism in still another way. He reported the case of a 14-year-old girl in whom a fatigue-stress fracture of a third metatarsal occurred 1 month following excision of the head of the adjacent second metatarsal because of Köhler's bone disease. The resultant disproportion between the required and the inherent capacity of the third metatarsal to bear additional stress presumably led to the fatigue-stress fracture.

Meyerding (3) reported a case of successive fatigue-stress fractures in four metatarsals, which were initiated by partial resection of the second metatarsal. In this case it had been impossible to rule out the presence of osteogenic sarcoma, which in fact was later erroneously diagnosed microscopically. After 4 months, another spindle-shaped callus mass was revealed roentgenographically in the third metatarsal, much as in the case reported by Hartley. Then 10 months after the resection of the fatigue-stress fractured portion of the third metatarsal, Meyerding's patient returned to him with fatigue-stress fracture of the first and fourth metatarsals.

Whereas Pfahler (4), Hansson (5) and Nordentoft (6) finally excluded malignancy in their cases of fatigue-stress fracture, Meyerding's case was not definitely diagnosed as march fracture. His patient, however, was still well 13 years later. The sequence of fatigue-stress fractures in the metatarsals subjected serially to stress beyond their structural capacity after resection of adjacent metatarsals, demonstrates nicely Hartley's theory.

Clement (7) also believed that fatigue-stress fractures usually were found in second and third metatarsals which were longer than the first metatarsal, and so were apt to be subjected to greater than normal stress and muscle pull by the lumbricales and interossei dorsales. In reviewing nine cases at this hospital all were found to have occurred in second or third metatarsals which were longer than the first. This may not be acceptable evidence in support of Clement's view since every roentgenologist observes a much larger number of cases with no fractures even though the second or third metatarsals are longer than the first. Clement's observation, nevertheless, may be significant.

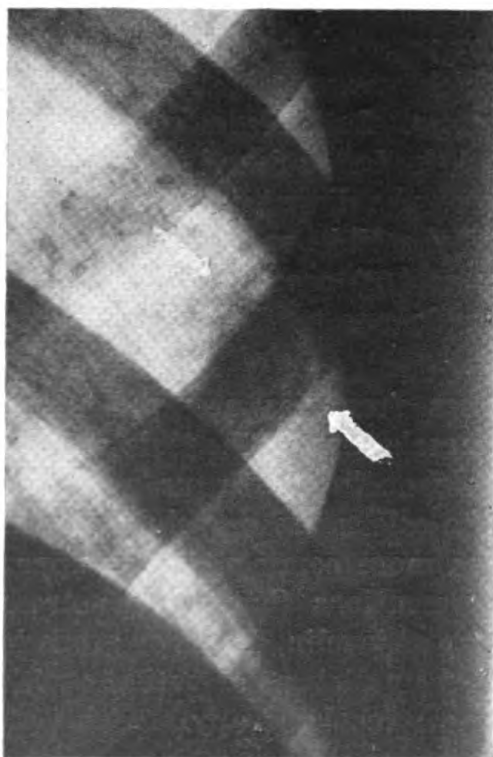
Scheller (8) recorded 590 examples of fatigue-stress fracture, 70 in the tibia, 13 in the femur, 12 in the fibula, 4 in the os calcis, 3 in the pelvis, and 488 in the metatarsals. Nickerson (9) recently reported 2 fractures of the pubic bones. Another instance of fatigue-stress fracture in this region was reported in 1941 by Mullard (10) who could find no similar report in the British literature up to that time. Hartley has seen 15 tibial fatigue-stress fractures since 1931. Pfahler reported an interesting case of tibial fatigue-stress fracture which presented difficulty in the differential diagnosis from malignancy. Both Hansson and Nordentoft had similar experiences and the latter found it necessary to do a biopsy before finally resolving the diagnosis. More examples of fatigue-stress fractures of the tibia were described by Weaver and Francisco (11). Burrows (12) commented on 2 cases involving the fibula which were analogous to the "ice skater's" fractures noted by Ingersoll (13).

Hartley found that fatigue-stress fractures occurred seven times more frequently in the metatarsals than in the tibia and six times more frequently in the tibia than in the femur or fibula, only once in a hundred times in the calcaneum or pelvis, and in the tibia he found them four times more common in the upper third than in other portions. He mentions that fatigue-stress fractures rarely occur in the humerus of javelin, discus or grenade throwers, in the ulna of diggers, in the vertebrae of patients with tetanus, or in individuals following metrazol therapy.

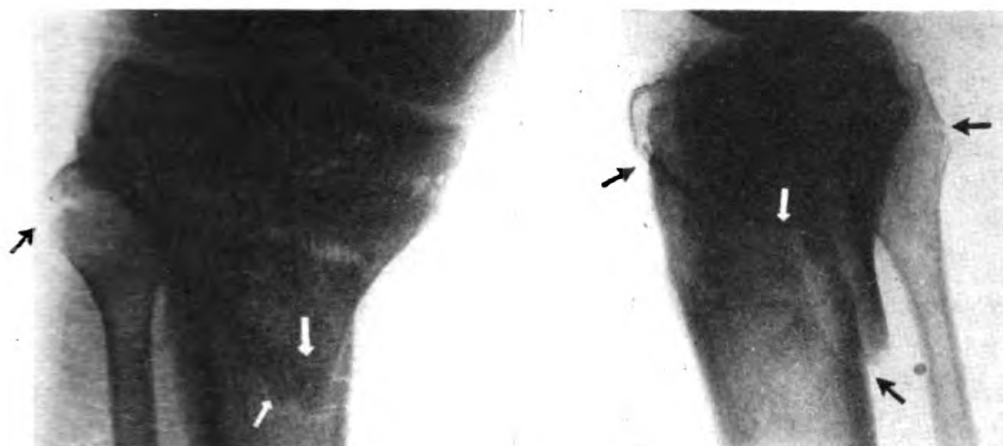
No one seems to have included under the category of fatigue-stress fractures those rib fractures which occur spontaneously in patients with a cough. These fractures bear a striking similarity to fatigue-stress fractures of other bones. The fracture lines are thin and for this reason frequently escape notice. They occur in apparently healthy bone. The formation of callus is rapid and the callus is often the first roentgenographic finding. Thus the peculiarities of these fractures meet the criteria of fatigue-stress fracture (figs. 1 and 2).

Most fatigue-stress fractures are seen during adolescent or young adult life. Roberts and Vogt (14) reported a case in a 4-year-old patient and Hartley in one 7 years of age. Seldom is a case reported after 25 years of age. Burrows mentioned a case in which the lower fibula was involved in a woman 61 years of age.

The extent of separation of the fragments of a fatigue-stress fracture depends in great measure on the degree of muscle pull. In the metatarsals where the pull by the lumbricales and interossei dorsales is not great, the range of fragment separation is limited. In other bones where larger muscles embrace the fragments, the spread between the ends may also be slight if the stress which caused the fracture occurred during ordinary physiologic use of the muscles; or the spread might be marked if the stress occurred



1. Fatigue-stress fracture of the anterior portion of the right seventh rib, not recognized at time of examination (case 2). Five weeks later callus had partially calcified, leading to recognition of the fracture.



2. Fatigue-stress fractures through tibial tuberosities, grade 3, and of fibular head, grade 1.

during immoderate pull of the muscles. Thus mere wide separation of the fragments must not lead to a misguided interpretation. It might be helpful, therefore, if fatigue-stress fractures were graded on the degree of distraction of the fragments (table 1).

TABLE 1.—*Grades of fatigue-stress fractures*

Grade 1	Grade 2	Grade 3
Subperiosteal-fracture line incomplete.	Fracture line linear and complete.	Fracture line complete and sometimes branched.
Fragments not displaced.	Fragments not displaced.	Fragments displaced and separated.
Symptoms delayed.	Symptoms immediate.	Symptoms immediate and often marked.
Callus formation often the first finding.	Fracture line seen in roentgenographs before callus forms.	Fracture is prominent.

In Mullard's case of a 27-year-old recruit, a fatigue-stress fracture of the femoral neck was sustained after a cross-country run of 4 miles which entailed running down a steep hill. His only symptom at the time was a slight stiffness of the hip. Three days later he went on a route march but had to fall out after 9 miles owing to increasing pain in the left hip. Nine days later, having undergone no further exertion in the meantime, he was sent to the hospital, barely able to hobble. The fracture line in the femoral neck was hardly visible in the roentgenograph. There was no appreciable separation of the fragments; the bone was normally calcified and no callus was visible. Thus, this fracture might be classified as grade 1.

An example of a fatigue-stress fracture, grade 3 of the tibia and grade 1 of the fibula, may be cited from our cases. A 35-year-

old recruit, 6 feet tall, weighing 201 pounds, sustained a fracture through the upper tibia and fibula spontaneously while he was hopping up and down alternately on each leg during a course of physical training. He had gone through the same exercises many times before and he claimed that, so far as he could determine, the manner of his exercising at the time of the accident was in no way different from that on previous occasions. Roentgenographic examination showed the separation between the ends of the fragments to be about 5 mm. in the tibia, but there was no separation of the fibular fragments (fig. 2).

Before making the final diagnosis of fatigue-stress fracture, it is necessary to exclude the presence of underlying local disease in the bone or generalized systemic disease that might be a contributing factor. This is not always easy. For instance, in the case reported by Roederer and Brainos (15) a spontaneous femoral transcervical fracture had occurred in a 40-year-old man 3 years previously without being recognized and was discovered when roentgenograms revealed a spontaneous transdiaphyseal fracture in the contralateral femur. Both accidents were trivial and involved no unusual activity. A pseudarthrosis had developed in the first fracture which originally was treated as "articular rheumatism" by bed rest for a period of 2 months with apparent cure, after which the patient had been allowed to resume his normal activities. Physical examination and laboratory findings revealed nothing abnormal except that the patient's lower limbs seemed small in relation to the rest of his bodily development. There was a congenital equinovarus deformity of one foot. Could these apparently unrelated findings have had a real bearing on the case?

Hartley (16) recently reported another instance of an "exhaustion" fracture of the spine which led him to conclusions that cannot be subscribed to without some question. This fracture occurred in the seventh dorsal vertebra of a 17-year-old boy who had been carrying heavy weights on his back. In this instance the possibility of an unrecognized dormant or incompletely healed adolescent osteochondritis may have been a contributing factor. This is another illustration of the difficulties that might be met in excluding a local or a systemic basis for fatigue-stress fractures which otherwise have all the characteristics of such fractures.

Weaver and Francisco believe abnormal metabolic changes or local subclinical nonsuppurative osteomyelitis to be causes of fatigue-stress fractures, excluding such causes of spontaneous "pathologic" fractures as osteitis deformans, rickets, chronic idiopathic steatorrhea, senility, "hunger" or "war deficiency" diseases, hyperparathyroidism, osteogenesis imperfecta and tumors.

Around fatigue-stress fractures the callus is laid down in a normal fashion, evolving quickly through the woven phase to the stage of lamination and organization, even without treatment, if there has been little or no separation of the fragments. With a fracture line not distinctly visible and with the callus forming a tumorlike mass so intimately connected with the periosteum, it is not hard to realize why a periosteal sarcoma might be first suspected. In fact this was the experience of Pfahler, Hansson, Nordentoft and Meyerding.

In some untreated cases where there has been separation of the fragments, the woven callus tends to accumulate on the side of the bone which sustains the most stress. In the tibia the preponderance of callus is likely to occur on the posteromedian aspects. This eccentric localization of callus often fails to obliterate the entire fracture line or cleft, and is sometimes mistaken for Looser's (17) "umbauzonen" as Roberts and Vogt seem to have done in analyzing some of their cases.

Although the diagnosis of fatigue-stress fractures is based predominantly on the callus-forming phase, the earlier stage, before the evolution of callus, is occasionally recognized by the appearance of thin lines of dissolution in healthy bone, often incompletely traversing the shaft at right or oblique angles. The clearest of roentgenograms are required, however, for these hairline fractures are easily overlooked if the detail in the film is not perfect. This was stressed by Hammond and O'Connor (18) who reported a series of occult fractures. In some cases examined immediately after an injury, the fracture was "occult" because it was not demonstrated in the roentgenograph, but after 10 or 15 days, callus could be seen, thus establishing the diagnosis. They urged that the surgeon rely more on his own than on the x-ray findings in

TABLE 2.—*Differential diagnosis*

Characteristics	Fatigue-stress fracture	Spontaneous pathologic fracture
Symptoms.....	Local pain usually during or after exercise.	No pain. If pain is present, it is not related to exercise.
Callus formation.....	Is prominent, forms normally and rapidly and undergoes normal lamination.	Is inconspicuous, tends to remain static and changes with progress of underlying or systemic disease.
Fracture line.....	Thin, often incomplete and margins may be ill-defined.	Relatively broad, clear-cut, at right angles to long axis of bone, and often extends across entire bone.
Types.....	Rarely multiple.	Frequently multiple.
Surrounding bone....	Healthy.	Diseased.
Systemic disease.....	None.	Often present.
Bones involved.....	Long, weight-bearing bones.	Not limited to weight-bearing bones; occurs often in forearms, scapulae, etc.

the initial treatment. Care must be exercised, however, in differentiating occult fractures from fatigue-stress fractures. Both may be occult at first, but fatigue-stress fractures are never caused by external violence, while the occult fractures described by Hammond and O'Connor may or may not be caused by external injury.

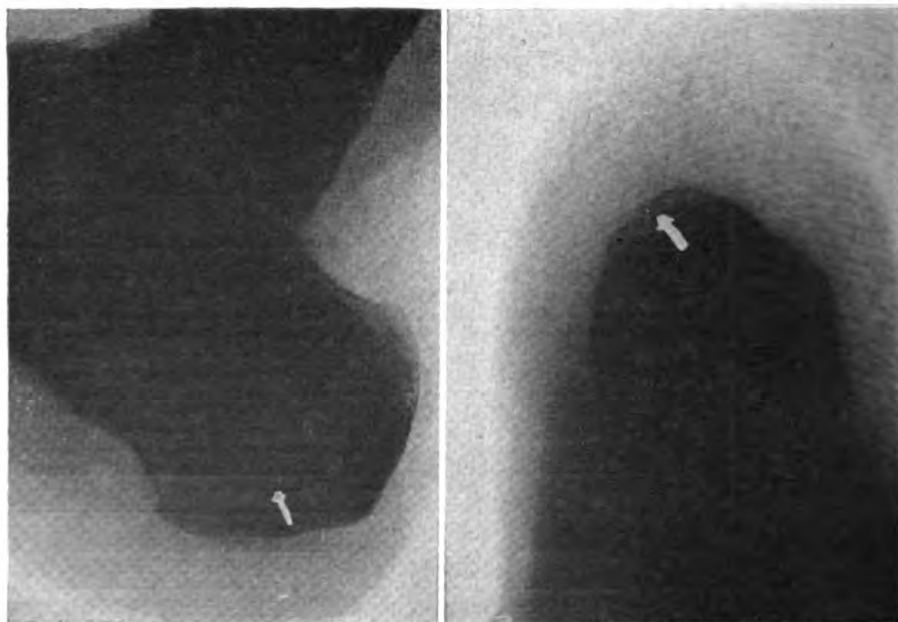
The differences between fatigue-stress fractures and spontaneous pathologic fractures might be summarized, as Hartley recommended, in table 2.

CASE REPORTS

Case 1.—An apprentice seaman, 21 years of age, weight 158 pounds, height 74 inches, became conscious of pain in his left heel after having engaged in the routine primary training of sailors. This included marching and running over smooth and rough terrain. The pain was not severe enough to prevent him from continuing with this training, but it became more intense suddenly after some commando maneuvers. A fatigue-stress fracture was found in the calcaneum by x-ray examination (fig. 3).

Case 2.—An apprentice seaman, 18 years old, 72 inches tall, weighing 129 pounds, was admitted to the hospital with the diagnosis of catarrhal fever, acute. After careful study it was found that he had had an intermittent dry nonproductive cough and some fatigue for 3 months, but no other symptoms. Three days prior to admission, after coughing, he experienced a "stitch-like" pain in the right lower part of the chest; the pain was aggravated upon coughing.

X-ray examination disclosed a minimal exudative patchy infiltration in the posterior base of the left lung and in the lower posterior portion of the left



3. Fatigue-stress fracture of the calcaneum (case 1).

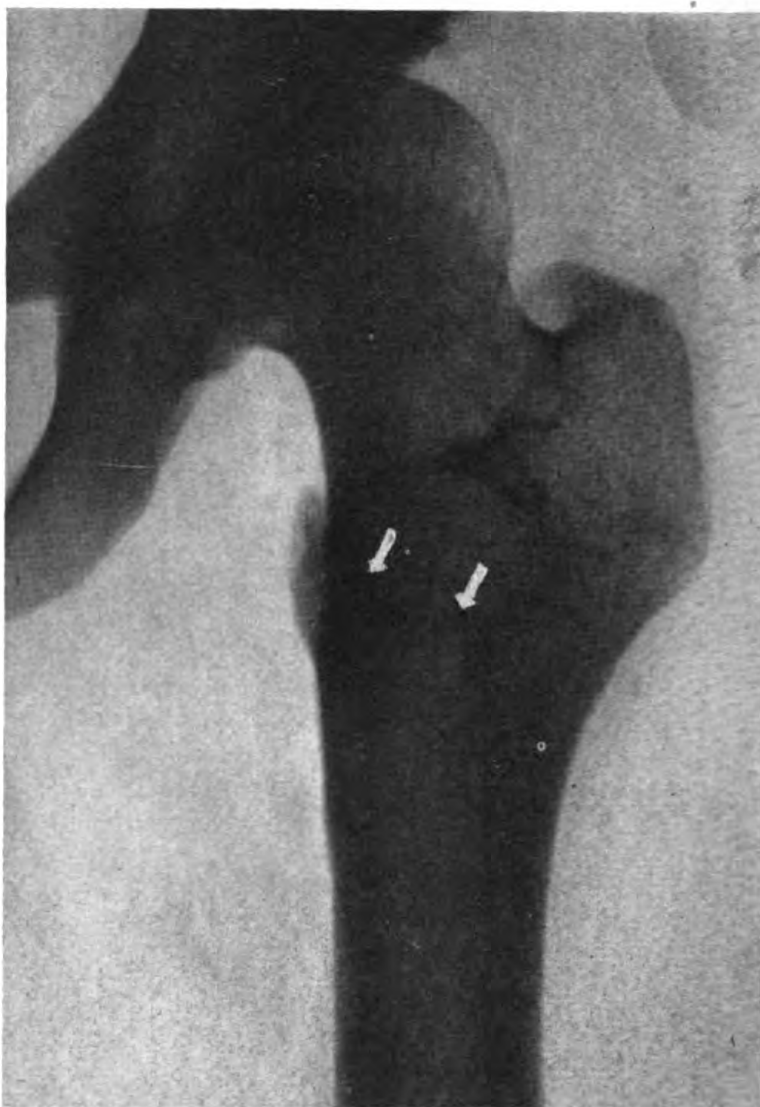


4. Fatigue-stress fracture through neck of femur about 14 days after onset of first symptom (case 3).



5. Fatigue-stress fracture (same case as figure 4) completely healed at end of 9 weeks; cast and rest constituted treatment.

upper lobe. A progress examination of the lungs made 5 weeks later revealed resolution of the lung processes, but some callus was noted around the ends of the fragments of a fractured right seventh rib, in the anterior axillary line, where the patient had said the pain was located. Reviewing the roentgenograms of the prior examination, it was found that a "spontaneous" frac-



6. Fatigue-stress fracture, subtrochanteric, long after healing (case 4).

ture had been overlooked, as frequently happens with this type of fracture (19) (fig. 1).

Case 3.—A 37-year-old apprentice seaman, 71 inches tall, weighing 180 pounds, noted some pain in his right hip after having been in recruit training for 3 weeks. The pain persisted for 2 weeks and seemed worse in the afternoons.

The physical examination led to a provisional diagnosis of acute myositis in the right hip region and he was admitted to the hospital. X-ray examination disclosed a fatigue-stress transcervical fracture of the right femur. The entire skeleton was examined to rule out malignancy and extensive laboratory studies were done, but nothing otherwise abnormal was found. A cast was applied, and at the end of 9 weeks complete bony union of the fracture had occurred (figs. 4 and 5).

Case 4.—An apprentice seaman, 26 years old, was sent to the hospital for examination because of slight asymmetry of the legs. At the age of 12, he

recalled, he had had pain in the right hip for which he had been confined to bed for 6 weeks, and which he believed was diagnosed as "rheumatism." The condition seemed to have been cured and he had had no further complaints.

X-ray examination here revealed a transverse line below the trochanters, not unlike a "growth line"—but the other bones did not reveal similar lines or any other abnormal changes. It is possible that this patient had a fatigue-stress fracture (fig. 6).

SUMMARY

1. Fatigue-stress fractures occur more commonly than is generally realized, and especially often in the armed services. They are seen most frequently in the second and third metatarsals, less frequently in the tibia, fibula, and femur, and rarely in the calcaneum, pubis, humerus, ulna and vertebrae.

2. The chief diagnostic criteria of fatigue-stress fractures are their occurrence in apparently healthy bone without external injury. The fracture lines are usually thin and overlooked. Callus is commonly the first definite diagnostic finding.

3. Some less frequently emphasized aspects of fatigue-stress fractures are mentioned, particularly their resemblance to osteogenic sarcoma.

4. Spontaneous fractures that occur in healthy ribs usually are fatigue-stress fractures.

REFERENCES

1. HARTLEY, J. B.: "Stress" or "fatigue" fractures of bone. *Brit. J. Radiol.* 16: 255-262, September 1943.
2. HENSCHEN, C.; STRAUMANN, R.; and BUCHER, R.: Ergebnisse röntgenspektrographischer Untersuchungen am Knochen; Krystallitbau des anorganischen und des organischen Knochens. *Deutsche Ztschr. f. Chir.* 236: 485-514, 1932.
3. MEYERDING, H. W.: Multiple metatarsal fractures associated with osteogenic sarcoma. *J.A.M.A.* 124: 228-230, January 22, 1944.
4. PFAHLER, G. E.: Insufficiency fracture of tibia resembling osteogenic sarcoma. *Am. J. Roentgenol.* 45: 209-213, February 1941.
5. HANSSON, C. J.: On insufficiency fractures of femur and tibia. *Acta radiol.* 19: 554-559, 1938.
6. NORDENTOFT, J. M.: Some cases of soldier's fracture. *Acta radiol.* 21: 615-621, 1940.
7. CLEMENT, B. L.: March fracture. *J. Bone & Joint Surg.* 26: 148-150, January 1944.
8. SCHELLER, F.: Überlastungsschäden am Knochengerüst junger Männer. *Med. Welt* 13: 1333-1336, October 7, 1939.
9. NICKERSON, S. H.: March fracture or insufficiency fracture. *Am. J. Surg.* 62: 154-164, November 1943.
10. MULLARD, K. S.: Spontaneous fracture of apparently normal neck of femur. *Brit. J. Surg.* 29: 241-244, October 1941.

11. WEAVER, J. B., and FRANCISCO, C. B.: Pseudofractures; manifestation of non-suppurative osteomyelitis. *J. Bone & Joint Surg.* 22: 610-615, July 1940.
12. BURROWS, H. J.: Spontaneous fracture of apparently normal fibula in its lower third. *Brit. J. Surg.* 28: 82-87, July 1940.
13. INGERSOLL, C. F.: Ice skater's fracture; form of fatigue fracture. *Am. J. Roentgenol.* 50: 469-479, October 1943.
14. ROBERTS, S. M., and VOGT, E. C.: Pseudofracture of tibia. *J. Bone & Joint Surg.* 21: 891-901, October 1939.
15. ROEDERER, C., and BRAINOS, A.: Fractures spontanées d'un col fémoral d'un côté et de la diaphyse fémorale de l'autre côté à trois ans de distance, chez un adulte n'étant atteint d'aucune affection nerveuse ou osseuse apparente. *Bull. et mém. Soc. d. chirurgiens de Paris* 30: 358-361, July 1, 1938.
16. HARTLEY, J. B.: "Exhaustion" fracture of spine; preliminary report on one case. *Brit. J. Radiol.* 16: 348-350, November 1943.
17. LOOSER, E.: Late rachitis and osteomalacia: clinical, roentgenologic and pathologico-anatomic investigations. *Deutsche Ztschr. f. Chir.* 152: 210, 1920.
18. HAMMOND, R., and O'CONNOR, D. S.: Occult fractures. *J.A.M.A.* 117: 500-504, August 16, 1941.
19. OECHSLI, W. R.: Rib fracture from cough; report of 12 cases. *J. Thoracic Surg.* 5: 530-534, June 1936.



MANAGEMENT OF THE RH PATIENT

It is suggested that an Rh determination be done on the blood of any patient who is to receive repeated transfusions, or who has received transfusions in the past.

When it is seen that conditions are present for a reaction, but the presence or absence of the Rh factor is not known, two courses are open, either an Rh determination on the recipient's blood or the use of an Rh negative donor. Of the two, the former is recommended as this settles the doubt and may conserve the supply of Rh negative donors. An Rh determination should be done on the blood of all pregnant women. All expectant mothers who are Rh negative should be hospitalized where Rh negative blood can be obtained both for the mother and child if need for transfusion arises following delivery. An adequate list of Rh negative donors in the four major blood groups should be made available for emergency use in any institution equipped to do transfusions.—COLLINS, C. C., and NICHOLSON, M. J.: Rh factor. *Anesthesiology* 5: 254-261, May 1944.

AERIAL EVACUATION OF THORACIC WOUNDED

CONSIDERATION OF EFFECTS OF ALTITUDE

ALFRED GOLDMAN

Lieutenant Commander (MC) U.S.N.R.

Aerial evacuation of the wounded from combat areas for definitive hospital treatment has become a common practice in this war. Wounds of the extremities and of the head offer little or no difficulty in aerial transportation when compared with those of gas-containing organs. During flight, owing to a decrease of atmospheric pressure with altitude, wounds of air-containing organs are subject to changes which may lead to anoxia and shock. Thus Flaherty and his coworkers (1) recommend the postponement of air evacuation of gastro-intestinal perforations until postoperative tympanites has disappeared. They also state that the transportation of chest injuries above 3,000 feet is not without danger. According to Schmoele and his associates (2) casualties with injuries of the chest have been safely and advantageously transported to rear Naval hospitals in the South Pacific despite the danger from diminished partial pressure of oxygen at high altitudes.

This safety is confirmed by a personal canvass of approximately 30 patients with pleuropulmonary wounds, most of which contained entrapped air. They were evacuated by flights of from 1 to 7 hours, almost all at altitudes below 3,000 feet. Most of the patients slept throughout the trip; a few required the administration of oxygen, and one was uncomfortable, with pain. The advantages of aerial transportation are particularly great for patients with wounds of the chest. These advantages are: (1) Shortened time; (2) smooth trip; (3) ease of loading; and (4) minimal handling.

Shortened time of transportation owing to increased speed and shorter distance of the direct lines of flight enables a patient to reach a Naval hospital from the front in approximately one tenth the time by land or sea. The great advantage of such a quick trip gives the patient access to x-ray examinations, trained specialists in thoracic surgery, anesthetists trained in intratracheal anesthesia, and expert nursing, all of which are so necessary to carry these patients through critical periods of their illness. Undoubtedly aerial evacuation has been important in producing the low hospital mortality encountered in the South Pacific (3).

A bumpy automobile ambulance ride is apt to be devastating to patients with injured thoraces. The sudden dyspnea and shock occasionally occurring when only slight bodily movements are made are well known to the thoracic surgeon. Such a ride may produce an increase of the pneumothorax, or hemorrhage, both intrapleural and intrapulmonary, dislodge a dressing holding closed a sucking pneumothorax, or increase the swing of a fluttering mediastinum. Cerebral and tissue anoxia resulting from such a ride might be far greater than that expected during smooth flight at ordinary altitudes.

While on duty at a South Pacific Marine air base a patient with an accidental gunshot wound of the left side of the chest, resulting in a large hemothorax, was safely transported by air to a Naval hospital 15 miles away. The bumpy ride that would have been necessary to cover the 35 miles of jungle road to that hospital might have proved fatal to this man.

In order that patients may arrive at the rear hospitals in the best of condition it is highly desirable to locate the hospitals as close to the landing strip as the military situation will allow. During a recent campaign patients evacuated 100 miles by air were subjected to a 15-mile ambulance ride over rough roads before reaching the hospital.

Stretcher cases are easily loaded in the DC3 ambulance planes. Patients wounded in the field may be transported directly to the plane from aid stations or evacuation hospitals, two men only being required to transfer the patient, who remains on the same stretcher during the entire trip of from 7 to 8 hours' duration.

Aside from the ease of loading, the minimal handling that goes with it affords less opportunity for bringing on shock, hemorrhage and dyspnea. Cough, frequently of paroxysmal type and often productive of blood, is apt to be induced. It is very important to avoid all but the most necessary handling of patients with pleuropulmonary wounds. Aerial transportation satisfies all these requirements.

Medical officers in attendance on such flights should not only be familiar with the several kinds of thoracic injuries but also should know the effects of altitude upon those injuries. Although anoxia is common to both thoracic injuries and altitude sickness, the latter will not be included in the scope of the present discussion.

The causes of anoxia are protean and the conditions must be correctly diagnosed in the evacuated patient, as the treatment of altitude sickness (oxygen therapy and decreasing altitude) will not be effective against the disturbed respiration arising from intrathoracic mechanical changes associated with pleuropulmonary

wounds. In this article emphasis will be placed upon altered intrathoracic pressures, particularly upon the differences of force exerted by the expansion of gases entrapped within the injured chest. These differences are induced by changes in atmospheric pressure associated with altitude.

Physiologic anatomy of entrapped air.—Atmospheric air is constantly flowing in and out of the bronchopulmonary tree with each respiratory cycle. Nowhere in the lung is air entrapped. But, as the result of wounds, air becomes entrapped in spaces normally not containing air (figs. 1 and 2) creating such conditions as pneumothorax and mediastinal emphysema. The ill effects of this entrapped air are brought about by the pressure or force which is exerted against enclosing walls or contiguous structures. In the mediastinum it compresses veins and thus interferes with venous return to the heart; in the pleural cavity, tension pneumothorax collapses the lung, displaces the mediastinum and depresses the diaphragm, all of which interfere with the mechanics of breathing; in the pericardium pneumopericardium cramps the heart, producing cardiac tamponade and diminished cardiac output. Such pressure effects create the altered anatomy, physiology, and the mechanical cardio-respiratory changes incident to the wound, which are affected secondarily by altitude.

Effects of altitude upon entrapped air.—Air entrapped in the body is affected by altitude according to Boyle's law, which states that the volume of any gas varies inversely as the pressure, providing the absolute temperature remains constant. In the formula

$$V = \frac{P}{P^1}, V, \text{ the comparative volume, is the ratio of the volume of}$$

saturated air entrapped in the body at sea level to the volume of saturated air at any given altitude. At sea level $V = 1.0$. P is the barometric pressure at sea level and P^1 the barometric pressure at the given altitude. Water vapor pressure at 37°C . is 47 mm. Hg. in saturated air. The comparative volumes of gas for given altitudes, for example, at 5,000 feet, are calculated from the formula:

$$\text{mula: } V = \frac{P - 47}{P^1 - 47} = \frac{760 - 47}{630 - 47} = 1.2. \text{ These data are compiled in table 1.}$$

Lovelace and Hinshaw (4) state that the increase of altitude has the effect of producing considerable increase either of the volume of air in the freely expanding pneumothorax or of the positive pressure within the pneumothorax if expansion is restricted (fig. 1).

Behavior of freely expanding pneumothorax.—From the figures

TABLE 1.—*The comparative volume of gas entrapped within the body at sea level and at various altitudes*

Relative volume of gas entrapped in body	Altitude, feet	Barometric pressure mm. Hg
1.0.....	0	760
1.2.....	5,000	630
1.5.....	10,000	520
1.9.....	15,000	430
2.4.....	20,000	350
3.0.....	25,000	280
4.0.....	30,000	230
5.4.....	35,000	180
7.6.....	40,000	140
8.8.....	42,000	130

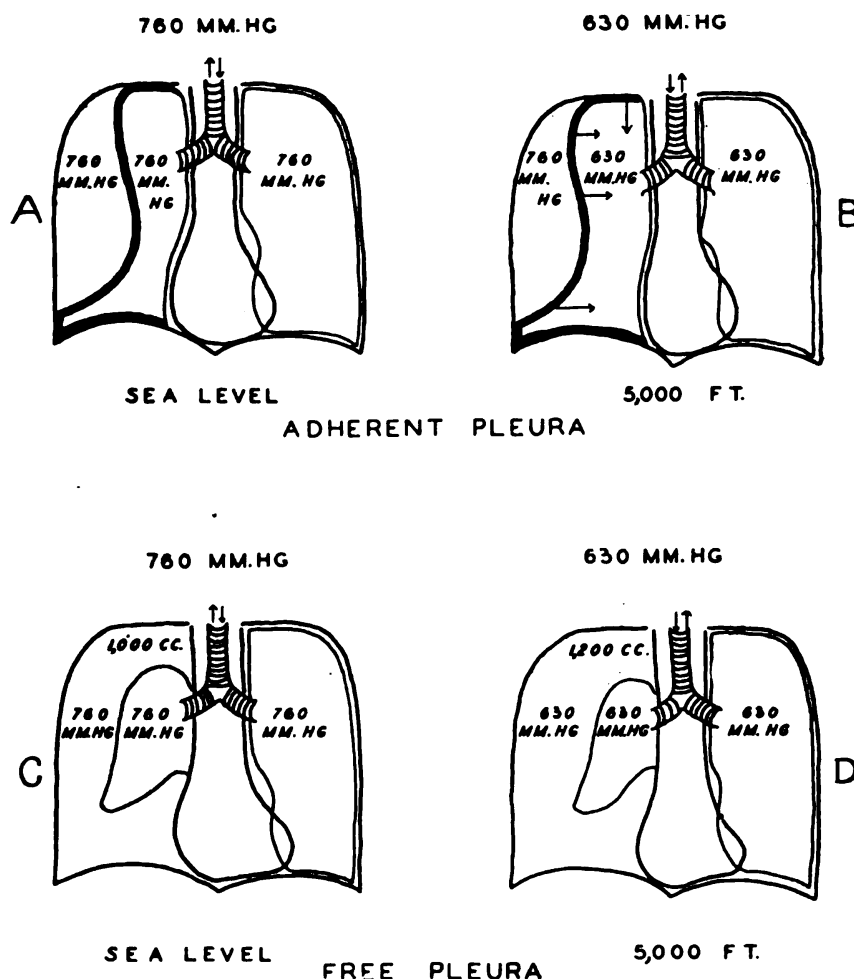
Saturated at 37° C., the water vapor pressure at this temperature is 47 mm. of Hg.

in the first column of table 1 we can estimate the volume of a freely expanding pneumothorax in a patient ascending from ground or sea level to any given altitude. For example, a pneumothorax of 1,000 cc. at sea level expands to $1.2 \times 1,000$ cc. or to 1,200 cc. on ascending to 5,000 feet, and during that ascent the pressure in the pneumothorax decreases from 760 mm. Hg. to 630 mm. Hg. (fig. 1C and D). Since intrapleural pressures are approximately equal to intrapulmonary pressures (fig. 1C) during quiet breathing, it follows that the final intrapleural pressures in any freely expanding pneumothorax ascending to altitudes will become the same as the atmospheric pressure of that altitude (fig. 1D).

Behavior of nonexpanding pneumothorax.—All of the air entrapped in pleural cavities is not freely expanding nor is the visceral pleura always elastic; air may be pocketed and the pleura itself adherent and thickened. Under these conditions altitude has the effect of increasing the positive pressure in the entrapped air. Such pressures usually produce pain (fig. 1A and B). The force resulting from these positive pressures may be estimated from the data in table 1.

With a nonexpanding pneumothorax on ascending from sea level, the volume remaining constant, the pressure of the pneumothorax air will remain the same, 760 mm. Hg., but the pressure of the alveolar air will be reduced to 630 mm. Hg. so that there is now a positive pressure in the pneumothorax equal to 130 mm. Hg., or 176.8 cc. of water. Positive pressures of this magnitude are not tolerated in the presence of adhesions (fig. 1B). However, all pneumothoraces associated with pleuropulmonary wounds will have some capacity for expansion, and so will exhibit changes in volume and pressure which tend to reduce the positive pressure.

The pain and dyspnea associated with such high positive pressure would be very severe since it is common to observe these symptoms in therapeutic pneumothoraces with adhesive pleuritis



1. Effect of ascent from sea level to 5,000 feet upon pneumothoraces with adherent and free pleurae.

- A. At sea level the pressures are equal in the pneumothorax, lungs, and atmosphere. The pneumothorax cannot expand.
- B. At 5,000 feet the pressure in the atmosphere and lungs has decreased from 760 mm. Hg. to 630 mm. Hg., but the pneumothorax pressure is still 760 mm. Hg. with the result that a positive force of 130 mm. Hg. acts upon the visceral pleura in the direction of the arrows, as long as normal compensatory changes cannot effect a reduction in pressure in the pneumothorax.
- C. At sea level the pressures in the atmosphere, lungs, and pneumothorax are equal.
- D. At 5,000 feet the pressures are still equal in the atmosphere, lungs, and pneumothorax but they have all decreased and reached an equilibrium at 630 mm. Hg. This occurs as the result of the increase of volume from 1,000 to 1,200 cc., as the pneumothorax pressure decreases from 760 to 630 mm. The increased volume of the pneumothorax is effected by the compensatory respiratory mechanism which here involves increase in thoracic girth, descent of the diaphragm and lastly decreased volume (collapse) of the homologous lung.

when the positive intrapleural pressure is only a few cubic centimeters of water. With such high intrapleural pressure, danger of rupture of adhesions is real, and according to Todd (5) personnel with artificial pneumothoraces should never fly above 6,000 feet for any length of time, and should not even for a few minutes go above 8,000 feet.

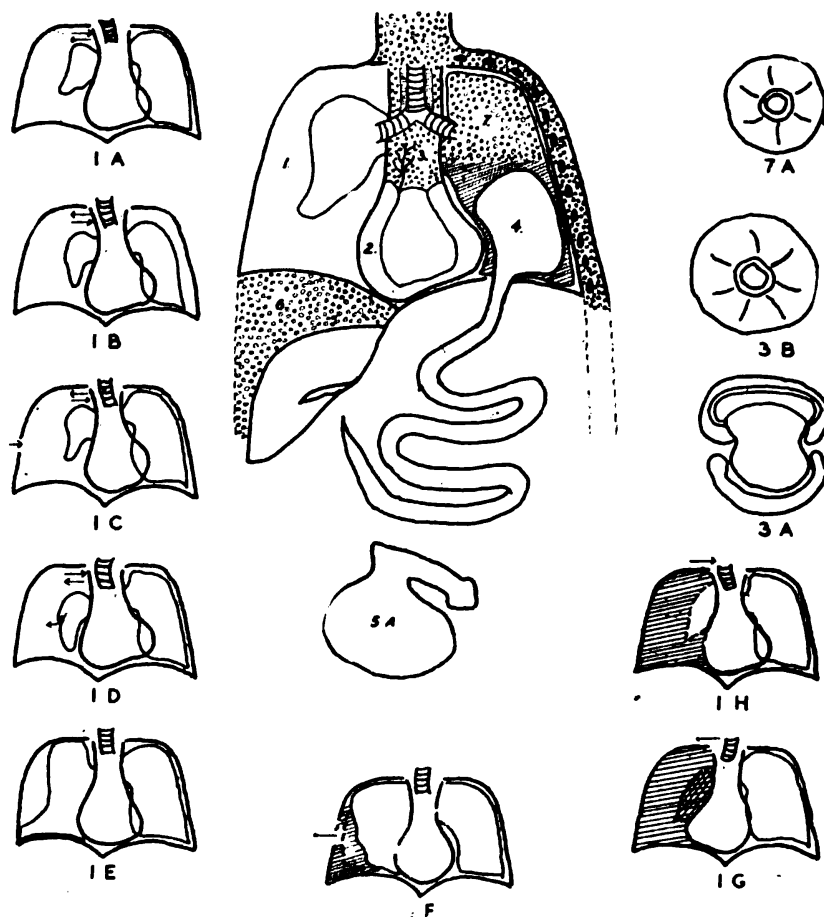
Stabilization of pleuropulmonary wounds.—On the other hand, the displacement effects upon the cardio-respiratory mechanism from the positive pressure are minimized by the pleuritis and adhesions, since they tend to prevent mediastinal shift.

Patients with fresh pleuropulmonary wounds often present a vivid picture of pain, dyspnea, shock and paradoxical breathing. Restlessness and fear are great and border on hysterical mania. A sense of impending death from suffocation associated with uncontrollable yelling may take place. This phase, during which the patient's condition is critical and unstable, may last up to 48 hours, and episodes may recur. Transportation of a patient in this unstable stage of the illness is apt to be fatal. When this situation occurs in aerial ambulances, judicious treatment with morphine, plasma, oxygen, psychotherapy and pleural decompression will be necessary.

By the time that pleuropulmonary wounds have developed adhesive pleuritis of any strength, and the acute phase has subsided, they are said to be stabilized. Some wounds associated with freely expanding nonadhering pneumothoraces are likely to be unstable in that leakage of air may continue with concomitant changes of mediastinal displacement. Other conditions, however, such as bleeding, shock, anoxia, mediastinal shift and flutter, and bronchial obstruction may contribute to an unstable thoracic wound. For some injuries time to complete compensatory adjustments in the cardio-respiratory mechanism must be allowed before any attempts to evacuate the patient are made. In general, patients with pleuropulmonary wounds should not be evacuated by air unless their condition has become stabilized.

Types of pneumothoraces.—Pneumothoraces are of various types. Figure 2. No. 1A, diagrammatically depicts a freely expanding simple closed pneumothorax. In this type, altitude (fig. 1C and D) produces an expansion which would be easily compensated for without producing mediastinal displacement, if the pneumothorax is small and the altitude not over 6,000 feet.

Closed tension pneumothorax.—(Fig. 2, Nos. 1B and D.) Here the intrapleural pressures are positive. This condition occurs after penetrating wounds (gunshot, stab, etc.) or crushing injuries with lacerations of the lung and production of broncho-alveolar communication which permits entrance of air into the



2. Sites of entrapped air associated with wounds of the thorax.

Center figure:

1. Pneumothorax.
2. Pneumopericardium.
3. Mediastinal emphysema.
4. Diaphragmatic hernia.
5. Subcutaneous emphysema.
6. Pneumoperitoneum.
7. Interstitial pulmonary emphysema.

Surrounding figures:

- 1A. Simple closed pneumothorax.
- 1B. Bilateral pneumothorax.
- 1C. Sucking or open pneumothorax.
- 1D. Tension closed pneumothorax.
- 1E. Nonexpanding, adherent pleurae, pneumothorax.
- 1F. Hemothorax; residuum of hemopneumothorax.
- 1G. Hemothorax with atelectasis.
- 1H. Hemothorax with aerated lung.
- 3A. Bleb of air in walls of trachea or large bronchus.
- 3B. Air in mediastinal vascular sheath.
- 7A. Air in pulmonary vascular sheath.
- 5A. Air in scrotum.

pleural cavity but prevents its escape (fig. 2, No. 1D). It may be recognized by dyspnea, increased after coughing or straining, hyperresonance of the chest, absent or tracheal breath sounds, displacement of the point of maximum apical impulse, cardiac dullness and trachea to the contralateral side. The effect of altitude is serious. The pneumothorax is freely expanding and signs of decompensation of the cardio-respiratory disturbances are already present at sea level. No patient with tension pneumothorax should be evacuated by air without:

1. Decompressing the pneumothorax by aspirating the air with a large needle.

2. If air continues to accumulate, introducing a catheter, size 18 to 22 French, into the pleural cavity and closing the open end with a finger cot or condom, provided with a quarter-inch hole. (A 16-gage needle may be strapped in place and left open to the atmosphere.)

3. In an emergency unplugging the wound to allow escape of air into the atmosphere.

When tension pneumothorax develops during flight the tension should be relieved by the same methods, and oxygen administered. Aerial ambulances should be equipped to perform pleural decompressions whenever patients with wounds of the chest are being carried. Sea level air is replaced by lower pressure altitude atmospheric air by unplugging the wound, thus aiding the decompression.

Open or sucking pneumothorax.—(Fig. 2, No. 1C.) Here the wound has caused communication through the chest wall permitting atmospheric air to be sucked into the pleural cavity with inspiration and expelled with expiration. The process is intermittent and varying amounts of air remain within the pleural cavity. Because of the almost constant changes in the intrapleural pressure cardio-respiratory disturbances are serious. All open or sucking pneumothoraces must be converted into closed simple pneumothoraces, by airtight wound closure or occlusive dressings with waterproof material such as heavily vaselined gauze. Altitude affects this type of pneumothorax by increasing the anoxia already at its limit of tolerance and by increasing the size of the pneumothorax after it has been converted to a closed one. The treatment is the same as for tension pneumothorax.

Bilateral pneumothorax.—(Fig. 2, No. 1B.) Not infrequently the vigorous respiratory efforts of a panic-stricken patient with a pleuropulmonary wound result in a marked strain of the contralateral lung, and rupture with resulting bilateral pneumothorax takes place. This condition is often overlooked and is difficult to diagnose without proper roentgenograms, but it should be sus-

pected when signs of cardio-respiratory decompensation persist even though the homologous pneumothorax has been controlled. Altitude effects are the same as for any pneumothorax, but the pneumothoraces' expansion is doubled and normal compensatory mechanisms are interfered with, i.e., the compensatory hypertrophy of the uninjured lung cannot take place. Therefore aerial transportation of such patients is especially dangerous. Oxygen and bilateral pleural decompression may be necessary.

Hemothorax.—All pleuropulmonary wounds are associated with bloody pleural fluid. The source of the blood may be from the chest wall (intercostal or internal mammary vessels), from the lung, or from the mediastinum. In figure 2, No. 1F, is depicted a hemothorax, the residuum of a hemopneumothorax. The mechanism probably is that intrapleural air is compressed out of the chest wall wound by the rising fluid. X-ray films taken a few hours after the occurrence of pleuropulmonary gunshot wounds frequently show little or no air in the pleural cavity which is opaque from a large accumulation of fluid.

Displacement of the mediastinum may vary according to the pulmonary condition as well as the amount of pleural fluid. In figure 2, No. 1G, is depicted mediastinal displacement to the homologous side associated with an airless, atelectatic, underlying lung. In figure 2, No. 1H, the mediastinal displacement is to the contralateral side, the lung is unobstructed and air containing, and the bleeding massive. Although signs of cardio-respiratory decompensation may be present, physical signs of fluid rather than air differentiate hemothorax from pneumothorax.

Altitude affects hemothorax in different ways than it does pneumothorax, since fluid is not expansile. By keeping the patient injured side down, the weight of the fluid is kept off the lung. Before and during flight hemothoraces should be aspirated only to relieve symptoms of mediastinal shift, and the fluid must *not* be replaced by air. During flight, if shock from persistent bleeding occurs, plasma and oxygen should be given.

Mediastinal and subcutaneous emphysemas.—(Fig. 2, Nos. 3 and 5.) These conditions are caused by penetrating wounds, or crushing injury, with lacerations of the bronchi or bronchus usually of large caliber which allow air to escape into the meshes of the mediastinum, into peribronchial (fig. 2, No. 3A), and vascular sheaths (fig. 2, No. 3B) as well as up the fascial planes of the neck, face, and pharynx. When seen early they are recognized by crepitation felt on pressure over the episternal notch and crackling heard over the sternum; if this is synchronous with the heart beat and heard when the patient holds his breath, the diagnosis of mediastinal emphysema is certain.

Such patients usually manifest severe dyspnea, and alarm, and as the subcutaneous emphysema spreads from the root of the neck in all directions to the tips of the fingers, and even to the scrotum, which frequently swells to the size of a football, they present a swollen, gruesome appearance. Dyspnea, which is usually marked, may be associated with pharyngeal, tracheal, or bronchial occlusion (fig. 2, No. 3A), pneumothorax or accompanying interstitial pulmonary emphysema.

Altitude affects mediastinal emphysema by increasing the widening of the mediastinum which results from an increased positive pressure of the entrapped air. The expansion of the mediastinal space with altitude compresses the contiguous lung and so diminishes pulmonary volume. Air entrapped within vascular sheaths would exert less of a compressing effect since arterial and venous pressures do not alter on ascent from sea level, and the compressive effect of this entrapped air would tend to decrease as it reached equilibrium with surrounding mediastinal air. It is possible that ascent to higher altitudes would decompress air-occluding veins in the mediastinum, but if this were attempted, oxygen should be administered during the ascent.

Ascent to higher altitudes to relieve symptoms of superior vena caval obstruction should never be attempted until a short incision through the skin in the suprasternal notch to permit the escape of mediastinal air has been made. The incision should be developed through the platysma and deepened into the mediastinum by blunt dissection with the finger. This procedure may be life-saving and flight surgeons should be prepared to do it. Only if this procedure fails should ascent to lower pressure atmosphere be attempted. Blebs of air entrapped in the posterior bronchial wall (fig. 2, No. 3A), contrary to venous obstructive effects, are affected adversely by altitude, in that ascent produces expansion of the air in the bleb and so the bronchial obstructive effects are increased. Lower altitude and oxygen is the treatment.

Pharyngeal emphysema may produce obstruction to air flow through the larynx. If this occurs the tissue at the base of the tongue may bulge with air and breathing will be stertorous. Emergency tracheotomy may be necessary and oxygen should be administered by catheter through the tracheotomy cannula.

Subcutaneous emphysema is affected by altitude in that the air entrapped beneath the skin expands and the skin is lifted still farther away from its underlying structure. In the scrotum, which is very expansile, air is frequently entrapped and tension of skin is produced that makes it glossy and smooth (fig. 2, No. 5A). Altitude would tend still further to increase the size of the

scrotum until it would become very painful. This pain is easily and quickly relieved by aspiration of the air with a 20- or 50-cc. syringe and a 16-gage needle.

Pneumopericardium.—(Fig. 2, No. 2.) Air entrapped within the pericardium acts in the same manner as air in the sheath of blood vessels and by its compressive effect diminishes cardiac output. Altitude affects this entrapped air so that decompression of the cardiac tamponade occurs as the parietal pericardium is sucked outward. Treatment is directed toward relief of tamponade effect by aspiration; the needle is inserted under the xiphoid and directed cephalad.

Diaphragmatic hernia.—(Fig. 2, No. 4.) Air in the intestines or stomach expands with altitude and when these organs herniate through a ruptured diaphragm, usually the left, the expanding gas compresses the lung, decreasing pulmonary volume. Abdominal cramps and even strangulation may result from the expanding gases.

Pulmonary interstitial emphysema.—(Fig. 2, Nos. 7 and 7A.) This condition may be associated with blast injuries of the chest where the compression wave has broken alveoli, and air follows the vascular structures in the pulmonary interstitial septa from the periphery toward the mediastinum, producing mediastinal emphysema. Altitude affects this in the same way as in mediastinal emphysema; the effect being to enlarge the space normally occupied by that lobe or lung, and decrease the number of available functioning alveoli.

Pneumoperitoneum.—(Fig. 2, No. 6.) Air in the abdomen may arise from therapeutic administration, from ruptured stomach or intestine, and from communication with the atmosphere. In therapeutic pneumoperitoneum the volume of air is apt to be two or three liters so that altitude which produces expansion of the gas is likely to produce abdominal discomfort and a feeling of fullness after eating small amounts of food. Pneumoperitoneum associated with wounds of the chest and abdomen is too small in volume to expect pressure changes; but pain referred to the shoulders may be common. This pain is relieved by keeping the patient flat.

COMMENT

All pleuropulmonary wounds are associated with varying degrees of cardio-respiratory disturbance. With rare exceptions altitude tends to increase that disturbance, but significant changes due to altitude are not likely to occur under the 3,000-foot level.

Over the South Pacific area, lengthy flights over water are almost always possible at levels under 500 feet; under these condi-

tions there are no definite contraindications for aerial evacuation. Weather, mountains, and the enemy may cause ambulance planes to fly at higher altitudes. When this happens the flight surgeon should be prepared for the emergencies that may arise.

Each thoracic wound must be individually considered, since the results are often bizarre. X-ray films are of inestimable value and whenever possible they should accompany the patient on his evacuation flight. The flight surgeon should personally pass on the condition of these patients and reject the unstable ones whose lives might be jeopardized by the flight and who by remaining could become stabilized.

SUMMARY AND CONCLUSIONS

1. Patients with thoracic wounds are advantageously evacuated from combat areas by air to rear areas in the South Pacific.

2. These patients should be evacuated at the lowest altitude possible, preferably at 500 feet, and heights over 3,000 feet avoided. Higher altitudes can produce emergencies.

3. Ambulance planes should be equipped to perform pleural decompression, tracheotomy, thoracentesis, and incision for mediastinal emphysema.

4. Accurate and complete diagnoses, including amounts and locations of entrapped air, are important in order to decide upon necessary therapy.

5. The types of injury associated with entrapped air are described and the effects of altitude upon this air are explained.

6. Application of Boyle's law to the effect of altitude upon entrapped air is described and made the basis for all explanations.

7. Pilots of ambulance planes should be made cognizant of the type of patient they are flying and be instructed by the flight surgeon as to altitudes which are safe for these patients.

REFERENCES

1. FLAHERTY, T. T.; YAVORSKY, W. D.; YOOD, N. L.; and MCWILLIAMS, J. G.: Evacuation of wounded by air from Battle of Guadalcanal. U. S. Nav. M. Bull. 41: 917-922, July 1943.
2. SCHMOELE, J. M.; HUSTON, H. R.; OWEN, E. P.; SIMON, J. I.; COBURN, D. F.; GILLESPIE, C. E.; and RIDGEWAY, E., Jr.: Surgical management of war wounds at U. S. Naval Base Hospital —. U. S. Nav. M. Bull. 41: 1525-1539, November 1943.
3. MCMAHON, A., and HUSTON, H. R.: War wounds of chest. U. S. Nav. M. Bull. 41: 1579-1587, November 1943.
4. LOVELACE, W. R., II, and HINSHAW, H. C.: Aerial transportation of patients, with special reference to traumatic pneumothorax, diaphragmatic hernia and mediastinal emphysema. War Med. 2: 580-585, July 1942.
5. TODD, G. S., and ANDERSON, D. M.: Effect of altitude on cases of pneumothorax. Lancet 2: 597-600, November 13, 1943.

ANESTHESIA ABOARD A HOSPITAL SHIP IN COMBAT AREAS

L. KRAEER FERGUSON
Captain (MC) U.S.N.R.

The recent literature contains numerous articles on the anesthesia to be used in combat areas. These are written with the best of intent and their theory is good, but they are unsatisfactory if they are intended to guide the surgeon in his choice of anesthesia in caring for wounded men. The difficulty lies in the fact that the authors are unable to visualize the conditions in combat zones; especially is this true with regard to the South and Central Pacific areas.

The patients are all young, robust individuals in good health. They tolerate and recover from shock remarkably well, especially with the help of intravenous plasma. The wound sites are mostly in the extremities. In a series of 3,333 battle casualties received aboard this hospital ship, there were 2,664 patients with open wounds. When the wound sites were tabulated as to location, it was found that of 4,713 wound areas, 3,148 or 66.6 percent were in the extremities; 1,381 of these were in the upper extremity and 1,767 in the lower. The incidence of wounds of the head and face was 6.8 percent, of the chest 7.4 percent and of the abdomen 2 percent. It is possible that some patients with the most serious wounds of the trunk and head did not live to reach the hospital ship, but the above tabulation is believed to be a fairly accurate cross section of the surgical casualties.

Most of the wounds occur in naval battles or in landings and jungle fighting on tropical islands. The wounded are cared for in emergency hospitals which are under constant danger from bombing and even naval shell fire. The equipment in these hospitals is emergency in type and must be easily transportable and renewed. Gas machines are out of the question in the early and busiest times in these hospitals.

The fighting usually occurs in a tropical climate where ether is difficult if not impossible to use unless a closed method can be employed. This is rarely possible until well established hospital facilities become available. The most easily transportable, readily available and replenishable anesthetics for such an area have proved to be novocain, for spinal or local injection or nerve block, and intravenous pentothal sodium.

The types of surgical procedures for which anesthesia is most frequently necessary are:

1. The reduction and immobilization of fractures. In our experience with battle casualties, 38.6 percent of the patients had fractures, and of these 83.6 percent were compound. Of 2,788 patients with wounds and contusions, 46 percent or almost half had fractures.

2. The care of wounds. It may be seen that many of the wounds are associated with fractures and that most of them are of the extremities. If morphine has been given, frequently an anesthetic is not necessary for the wound treatment.

3. The removal of foreign bodies. This may also be a part of the care of the wound, but frequently further exploration or a new exploratory incision must be made. About 20 percent of the operations for which anesthesia was used were performed for the removal of foreign bodies.

4. Less frequent operations for which anesthesia is necessary are incision and drainage of infected wounds and joints, ligation of bleeding vessels, and amputations, major and minor.

There are a few emergency surgical procedures such as exploration of abdominal wounds, closure of sucking chest wounds, relief of urinary retention, and ligation of bleeding arteries, that require anesthesia. The essential emergency care, i.e., treatment of shock with plasma, immobilization of fractures in temporary splints (using morphine to relieve pain), and the care of the wound with lavage and sulfonamides, may not require anesthesia. The patients are transported as soon as possible, usually within 24 to 48 hours, by plane or ship to a safer, better equipped hospital. Here transfusions or other supportive measures may be given. By the time the patient comes to the operating room, shock is not an important factor even in seriously wounded patients. They tolerate spinal anesthesia very well. In 215 wounded patients to whom spinal anesthesia was given, shock occurred in 2 who had serious compound fractures of the femur. This was easily controlled by plasma infusions.

Professional anesthetists, even nurse anesthetists, are not always available in front-line hospitals where the seriously wounded are cared for. The surgeon is usually called upon to give or to assume the responsibility of giving the anesthetic.

Hence the choice of anesthetic is narrowed down to one that the surgeon can supervise or give to a robust, young patient in whom shock is not a prominent factor, and one which is suitable for treating wounds, reducing and immobilizing fractures, mostly compound, removing foreign bodies, and performing other operations in a tropical area not well suited for open-ether adminis-

tration. Novocain for spinal, local, and block anesthesia, and intravenous pentothal sodium best fulfill the requirements.

This ship operated in the South Pacific area from the beginning of the Solomon Islands campaign. It served both as a hospital and an ambulance ship, receiving patients from forward hospitals and transporting them to rear areas. The ship is equipped with every modern facility that would be found in a medium-size hospital on land.

The patients were received 12 hours to 3 weeks after injury, depending upon the speed of transport to the forward bases and when the hospital ship reached those harbors. The majority of the patients came aboard from 3 to 10 days after injury. In other instances the patients were received from ships or transports.

The most active period was for 6 months beginning with the original landings at Guadalcanal and ending when active Japanese resistance stopped on that island. During this period, 6,807 patients were admitted to the ship, of which 3,333 were surgical battle casualties. Some of the patients had received definitive treatment before coming aboard. Little more than emergency treatment had been given to others, so that the operating rooms were kept busy throughout the trips to the rear bases, especially in the early phases. In a three-table operating suite, as many as 38 cases were handled in 1 day, the average being about 20.

In addition to this experience in war casualties, the ship acted as a base hospital for a considerable period. On the surgical side, the usual surgical emergencies, accidental injuries and surgical diseases seen in civilian hospitals were under our care.

A review is presented of the anesthetics employed during the year beginning 14 August 1942 when our first casualties came aboard. The anesthetics available on the ship were ether open-drop, ether closed-method, nitrous oxide and oxygen, pentothal sodium, avertin, novocain crystals or pontocaine solution for spinal anesthesia, and novocain solution for local infiltration field and nerve blocks.

Most of the time a nurse anesthetist was available, but for a period from early September until mid-December, when surgical casualties were heaviest, the surgeons were called upon to give inhalation anesthesia, if necessary. During this time 509 operations were performed and inhalation anesthesia was not used at all. Intravenous pentothal sodium was employed in 27 cases as a general anesthetic.

This experience is cited to demonstrate that it is possible to carry on successfully without the use of inhalation anesthesia in seriously injured patients, and subsequent experience showed that

our preference would not have changed even with a competent anesthetist aboard.

TABLE 1.—*Summary of anesthesia for 1,142 operations*

	Traumatic cases	Nontraumatic cases
Local.....	217	203
Local and intravenous pentothal.....	1	0
Plexus block.....	8	1
Plexus block and nitrous oxide-oxygen.....	1	0
Spinal.....	210	172
Spinal and nitrous oxide-oxygen.....	1	3
Spinal and intravenous pentothal.....	4	1
Intravenous pentothal.....	59	8
Ether.....	3	0
Nitrous oxide-oxygen.....	15	12
Refrigeration.....	1	0
No anesthesia (morphine).....	222	0
Total.....	742	400

Preoperative medication.—Morphine sulfate, $\frac{1}{4}$ grain and atropine sulfate, $\frac{1}{150}$ grain, were the only preoperative medications used. This was given by hypodermic injection about 1 hour before the time set for operation. In 222 cases, no other drugs were used as anesthetic agents (table 2). Most of these cases were compound fractures, the majority of them of the upper extremity. It was possible to irrigate and dress the wounds, reduce the fracture and apply immobilization dressings without much discomfort to the subject. A few patients felt faint when they sat up for the first time, but they soon recovered their vasomotor stability, usually without any treatment except a little aromatic spirits of ammonia.

Local anesthesia, field block and nerve block.—Much has been made of the possibility of "psychologic injury resulting from a knowledge that he is being operated upon" as a factor in pro-

TABLE 2.—*Operating room procedures without anesthesia*

Procedure	Number cases
Reduction and immobilization of fractures:	
Scapula.....	3
Clavicle.....	8
Humerus.....	30
Forearm.....	42
Carpus.....	10
Hand and fingers.....	24
Vertebrae.....	3
Pelvis.....	2
Femur.....	4
Patella.....	3
Leg.....	33
Malleolus.....	9
Ankle and foot.....	29
Wound dressing and application of cast.....	18
Removal of foreign body.....	2
Wound suture.....	2
Total.....	222

TABLE 3.—*Summary of local anesthesia*

Procedure	Traumatic cases	Nontraumatic cases
Removal of foreign body	75	
Incision and drainage	17	18
Wound suture	12	
Aspiration of joint	47	
Skin graft	6	
Amputation of digit	3	
Reduction of fracture and application of cast:		
Pin insertion	4	
Scapula	1	
Clavicle	4	
Forearm	13	
Hand	10	
Finger	7	
Vertebrae	3	
Malleolus	5	
Foot	5	
Toe	2	
Humerus, radius and ulna*	1	
Reduction of sternoclavicular dislocation	1	
Reduction of subtemporal decompression	2	
Herniorrhaphy		29
Minor operation		87
Ligation of vein		6
Biopsy		10
Operation for cyst, teratoma		27
Anal operation		15
Mastectomy		3
Other operations		8
Total	218	203

* Local anesthesia and intravenous pentothal sodium.

ducing "bad reactions" in seriously injured patients, and Beecher¹ even states that "local anesthesia is in general best restricted to rather phlegmatic or apathetic patients for even minor surgical procedures." In our experience, there were no "bad reactions" in seriously injured patients operated upon under local anesthesia, and it was not necessary to select any certain type of psychologic make-up for this type of anesthesia. The only requirement was the production of complete anesthesia in the operative field.

In 519 cases of acute trauma, local anesthesia as an infiltration or field block was employed 218 times (table 3). Complete anesthesia was not obtained in 1 case and intravenous pentothal sodium was given in addition. There were no untoward or bad reactions.

Foreign bodies were removed in the course of the treatment of many wounds and the reduction of many compound fractures, but of the 104 operations solely for the removal of foreign bodies, 75 were performed under local anesthesia. Novocain in 1-percent solution was used in a fairly wide-line infiltration. It is of course important to obtain an accurate localization before the operation is started.

The use of novocain solution as an anesthetic for the reduction of fractures is a well-established practice. In some instances, it

¹BEECHER, H. K.: Choice of anesthesia for seriously wounded patients. J.A.M.A. 121: 899-903, March 20, 1943.

was injected directly into the fracture site; in others, it was used as the anesthetic for the introduction of traction pins or wires.

Novocain in a line infiltration was used in many cases for the incision and drainage of infections, both in traumatic and non-traumatic cases. The incision is made through the line of infiltration, and there has been no evidence of any spread of the infection by this method of treatment.

Brachial plexus block.—Brachial plexus block offers an excellent anesthesia for procedures on the forearm and hand. The technic is not difficult. The only disadvantage lies in the fact that the surgeon must often wait 15 or 20 minutes until the anesthesia is complete. It cannot be well used when there are wounds or infections of the neck.

Block anesthesia was used in 10 cases, and in 1 of these nitrous oxide-oxygen was given because of incomplete anesthesia (table 4).

TABLE 4.—*Summary of brachial plexus block*

Procedure	Traumatic cases	Nontraumatic cases
Reduction of fracture, forearm.....	5	.....
Reduction of semilunar dislocation.....	1	.....
Removal of foreign body, forearm.....	1	.....
Amputation of finger*.....	2	.....
Excision of ganglion.....	.....	1
Total.....	9	1

* N₂O and O₂ also given in 1 case.

Spinal anesthesia.—In the literature, there is considerable controversy as to whether spinal anesthesia should be used in severely injured patients. The question at issue is really whether spinal anesthesia, with its known possibility of producing a fall in blood pressure, should be used in cases of shock or impending shock. There is a difference in these two propositions. All seriously wounded are not in shock, or at least not continuously so, especially if plasma, pain relief and rest can be provided. Operation should be delayed until recovery from shock is complete except in three instances: (1) Abdominal wounds; (2) sucking chest wounds; and (3) hemorrhage from large arteries. In these conditions, the operation may be looked upon as a part of the treatment of shock along with transfusions, plasma, morphine, and bed rest. Even in the case of an open pneumothorax, it may be possible to delay operation by an adequate wound plug and pressure dressing, and in arterial hemorrhage by the application of local pressure or a tourniquet.

In our experience with seriously wounded, shock has not been

a troublesome factor. Patients were prepared for operation by transfusions when necessary, so that the hemoglobin reading was more than 50 percent, preferably 60 percent. Ephedrine sulfate, 50 mg., was injected before the anesthetic was given.

As a prophylactic measure in a few patients, an intravenous infusion of plasma or saline was started as soon as the patient was in position on the table. There were some falls in blood pressure with a gradual return to preanesthetic level. Clinical shock appeared in 2 patients with compound fractures of the femur but was controlled by 500 cc. of plasma intravenously in each case.

The value of spinal anesthesia is apparent when one considers the large proportion of wounds and fractures in the lower extremity. The ease of administration, the almost immediate complete anesthesia, the perfect relaxation, and the lack of postoperative complications are advantages that recommend it to the surgeon.

Novocain crystals, 150 mg., were used in all but a few cases. When longer anesthesia was desired, 200 mg. were employed and in a few cases pontocaine hydrochloride was used. The height

TABLE 5.—Summary of spinal anesthesia

Procedure	Traumatic cases	Nontraumatic cases
Reduction of fracture and application of cast:		
Pelvis.....	4	
Femur.....	75	
Patella.....	¹ 10	
Lower leg.....	² 55	
Malleolus.....	7	
Leg and foot.....	6	
Os calcis.....	5	
Foot.....	4	
Dislocation of knee.....	2	
Removal of foreign body, knee.....	11	
Removal of foreign body, leg.....	³ 7	
Amputation.....	5	
Incision and drainage.....	8	3
Ligation of pulsating hematoma.....	3	
Skin graft.....	2	
Suture of wound.....	1	
Excision of coccyx.....	1	
Exploration of abdomen.....	6	1
Repair of ruptured urethra.....	3	
Herniorrhaphy, inguinal.....		27
Herniorrhaphy, ventral.....		2
Appendectomy.....		⁴ 77
Excision of Meckel's diverticulum.....		1
Anal operation.....		10
Renal lithotomy.....		3
Varicocelelectomy.....		2
Excision of pilonidal cyst.....		2
Arthrotomy, knee.....		37
Arthrotomy, hip.....		1
Excision of bone tumor.....		7
Plastic for hammertoe.....		1
Suture of ruptured ulcer.....		¹ 1
Relief of intestinal obstruction.....		³ 1
Total.....	215	176

¹ N₂O and O₂ also given in 1 case.

² Intravenous pentothal sodium also given in 2 cases.

³ Intravenous pentothal sodium also given in 1 case.

⁴ N₂O and O₂ also given in 2 cases.

of the anesthesia was kept as low as possible and was controlled by tilting the operating table.

Spinal anesthesia was used in 391 cases, of which 215 were traumatic and 176 nontraumatic (table 5). In 4 of these cases, the anesthesia was augmented with nitrous oxide and oxygen and in 4 others with intravenous pentothal. This represents a failure to produce adequate or sufficiently long anesthesia in about 2 percent of the cases. Of the 215 operations performed for traumatic lesions, 201 were for wounds, fractures or infections of the lower extremity. The other 14 were operations upon the pelvis and abdomen.

General anesthesia.—General anesthesia was used relatively infrequently because most of the procedures did not require it, and because both the patient and the surgeon preferred some form of local anesthesia. It was used for operations in which several extremities were involved, for operations upon the upper extremity where local or brachial plexus block did not seem indicated, for incision and drainage of infections, and in a few cases for the first dressing of painful wounds. In 1,142 operative procedures, a general anesthetic was given 97 times (8.5 percent). In addition, a general anesthetic was used to augment some form of local anesthetic 11 times.

Intravenous pentothal sodium.—The general anesthetic used most frequently aboard this ship was pentothal sodium. Since 30-cc. syringes were available and the distilled water was packaged in 10-cc. ampules, 1 gm. of the pentothal powder was dissolved in 30 cc. of distilled water to make a 3.3-percent solution. This was found to be sufficiently strong to give good anesthesia without using too much solution and sufficiently weak to be safe. Hospital corpsmen were trained to give this anesthetic and there were no untoward complications from this practice. We found this anesthesia to be extremely satisfactory except for operations about the jaw. In patients with wounds of the face and compound fractures of the jaw, an intravenous anesthetic would seem to be a happy solution to the anesthetic problem. However with swelling of the tissues of the floor of the mouth and tongue, respiratory difficulty became such a prominent and distressing symptom that intravenous pentothal sodium was discontinued and local anesthesia used.

Pentothal was used in 59 traumatic cases and 8 nontraumatic procedures, or 5.8 percent of the 1,142 operations (table 6). It recommends itself as a general anesthetic in battle zones because it requires no cumbersome apparatus, does not vary with temperature, produces rapid anesthesia with rapid recovery, and may be prolonged as desired without harmful effects.

TABLE 6.—*Summary of intravenous pentothal sodium*

Procedure	Traumatic cases	Nontraumatic cases
Reduction of fractures:		
Face and jaw	10	
Humerus	3	
Forearm	14	
Hand	3	
Leg and foot	3	
Leg and arm	4	
Manipulation of joint		4
Removal of foreign body	7	
Dressing of wound	3	
Skin graft	2	
Incision and drainage	3	3
Amputation of finger	1	
Ligation of artery	2	
Suture of wound	2	
Reduction of dislocation	2	
Nerve transplant		1

TABLE 7.—*Summary of inhalation anesthesia*

Procedure	Traumatic cases	Nontraumatic cases
ETHER		
Reduction of compound fracture, femur and tibia	1	
Suture of wounds, elbow and scalp	1	
Reduction of compound fracture, elbow	1	
NITROUS OXIDE AND OXYGEN		
Incision and drainage, gas gangrene, leg	3	
Removal of foreign body	2	
Reduction of compound fracture, forearm	5	
Suture of wound	2	
Ligation for secondary hemorrhage	1	
Skin graft	1	
Plastic of shoulder joint		4
Orthopedic operation, arm		4
Incision and drainage of infections	1	4

Ether and nitrous oxide and oxygen.—Ether and nitrous oxide and oxygen were used in 30 cases, 2.6 percent of 1,142 procedures (table 7). Nitrous oxide and oxygen is probably the anesthetic of choice for the incision and drainage of gas gangrene.

Refrigeration anesthesia.—A word should be said about anesthesia in cases of gas gangrene. This infection may appear any time from the second to the eighth day after injury, and within a relatively few hours the patient may progress to a state of shock, with low blood pressure (70 to 80), a leukocytosis of 30,000 to 40,000, fever and marked pain in the leg.

Our experience with gas gangrene has led us away from the use of spinal anesthesia. On theoretical grounds, nitrous oxide and oxygen would appear preferable for incision and drainage of gas-bearing tissues, but if amputation is definitely decided upon, the choice would be refrigeration anesthesia and a tourniquet. We had one patient with gas gangrene whose pulse could not be taken. His blood pressure was 50. He was given plasma dur-

ing the 2-hour period of refrigeration and an amputation was performed. With large doses of antitoxin intramuscularly, transfusions and sulfathiazole, this patient recovered and left the ship in good condition.

Local anesthesia and the sulfonamides.—The literature contains several articles which appear to show that novocain may inhibit the bacteriostatic effect of the sulfonamides. Most of these conclusions have been drawn from in vitro experiments and are no doubt valid on theoretical grounds.

From a practical standpoint, however, it is questionable whether the small amount of novocain used as a local infiltration has any prolonged inhibiting effect upon the bacteriostatic action of a locally applied sulfonamide. Certainly the local anesthetic effect of novocain rarely lasts more than 1 hour, whereas sulfanilamide locally applied exerts an effective action for almost 24 hours, and sulfathiazole for about 4 days. It is doubtful that novocain used as a spinal anesthetic could affect the action of a sulfonamide applied in a wound.

In a clinical impression gained from observing more than 5,000 wounds, the sulfonamides seemed to be equally effective in wounds operated upon under a local anesthetic and in those in which novocain had not been used.

SUMMARY

1. The choice of anesthetic agents in combat zones must include a consideration of the condition of the patient, the climate, the transport facilities and the type of operation to be performed.
2. Local, spinal and intravenous pentothal sodium have been found most useful in our hands for operations upon both traumatic and nontraumatic lesions.
3. Many patients with large wounds and those with fractures of the upper extremity need no anesthetic if morphine in adequate dosage is given preoperatively.
4. No special psychologic type is believed necessary for the use of local anesthetics in cases of trauma.
5. Severely wounded patients tolerate spinal anesthesia very well if shock has been adequately treated or if a prophylactic plasma injection is given during the operation.
6. Pentothal sodium as an intravenous anesthetic is satisfactory, safe, and requires no cumbersome apparatus.
7. Nitrous oxide and oxygen is probably the anesthetic of choice for incision and drainage of gas gangrene. For amputations for gas gangrene, refrigeration anesthesia is preferred.
8. It is probable that the inhibiting effect of novocain on locally applied sulfonamides is of no practical importance.

PATHOGENIC ENTERIC BACILLI

I. PARACOLON, PROTEUS AND PSEUDOMONAS GROUPS

LAVERNE A. BARNES

Lieutenant Commander H-V(S) U.S.N.R.

Since the report in July 1943 (1) the scope of work in the Enteric Pathogen Laboratory at the Naval Medical School, Bethesda, Maryland, has expanded to include all of the gram-negative enteric organisms known to be, or suspected of being, pathogenic for man. Although the routine practice is to report the specific type identity of an organism forwarded for typing, it happens occasionally that only the broad group to which the particular species belongs can readily be determined; in such instances, it can safely be concluded that the culture does not conform to the characteristics of any *known* pathogen. On the other hand, opportunities are being presented to gather epidemiologic and bacteriologic information regarding the significance in disease-production of certain organisms about which evidence has hitherto been rather scanty, such as certain members of the coliform, proteus, and pseudomonas groups. It is highly desirable to continue these observations.

The purpose of this report is to present information regarding the enteric pathogens, with the objectives of stimulating interest in the various organisms concerned and facilitating early recognition of possible etiologic agents in cases or outbreaks of gastroenteritis, enteric fever, or dysentery. It is proposed to divide the discussion into five sections: A, the paracolon group; B, the proteus group; C, the pseudomonas group; D, the salmonellas (including *Eberthella typhosa*); and E, the shigellas. The first three groups form the subject material for the first paper in this series; the salmonellas and the shigellas are to be covered in two subsequent publications. In this first article will be found a discussion of suggested procedures for the tentative identification of the enteric pathogens; it is urged that all cultures so diagnosed be forwarded via official channels to the Enteric Pathogen Laboratory for serologic confirmation and for the purpose of centralizing epidemiologic information.

A. THE PARACOLON GROUP.

Within the large class of organisms referred to as coliform-intermediates is included a long series of heterogenous organisms that, for the purposes of this discussion at least, may be con-

sidered taxonomically to lie between the true *Escherichia* (*B. coli*) and the salmonellas. As stated by Topley and Wilson (2), "certain of these species are definitely pathogenic for man. Others are under suspicion in this respect. Others again are almost certainly nonpathogenic."

For the sake of orientation, it is proposed that the term "paracolons" be restricted to apply to those organisms defined as aberrant coliforms isolated from man, especially in cases of gastroenteritis, as recommended by Stuart and his coworkers (3). The organisms included in this group that are at present of medical importance fall into four categories.

1. Stuart and Rustigian (4) have collected strong evidence of the pathogenicity of one type of paracolons which they have designated as "Bio-type 32011." Within Bio-type 32011 are eight "sero-types" of the strain. The organisms belonging to this type have no major antigens in common with the salmonellas, but there is some evidence of a minor relationship with one of the shigella antigens. Members of Bio-type 32011 have been identified at the Laboratory among cultures isolated during outbreaks of gastroenteritis affecting Naval personnel. Epidemiologically and bacteriologically Bio-type 32011 appears to have been the etiologic agent in epidemics of gastroenteritis cited in the preceding reference; 18 of the strains were isolated from "typhoid suspects."

2. A second group of paracolons has been described by Stuart and his associates (5) that may have been implicated in an epidemic of gastroenteritis in infants. This group of 42 organisms is of interest in that they are related, through major antigens, to *Shigella alcalescens*.

3. Another reference to paracolons of probable pathologic significance is to be found in a recent article by Adams and Atwood (6) who recovered the organism from stools in 33 cases of acute diarrhea among military personnel; 20 of these cultures agglutinated to titer with one of the somatic salmonella antisera.

4. Kauffmann (7) lists about 9 strains of coliforms which are, unfortunately, placed in his list of salmonellas due to the presence in the organisms of Vi, somatic, or flagellar antigens (or combinations thereof) that occur in established salmonella types; some of these, at least, conform to the definition of paracolons. In view of subsequent observations it would be highly desirable to delete the Kauffmann strains from the ever-growing roster of authentic salmonellas, and to study their relationship to other paracolons.

In addition to the paracolons mentioned above, there is a large, heterogeneous group of coliforms that have been described by various authors; they are of interest in that some of them have

been isolated from animals and must be considered as potential human pathogens; with others the interest lies in their antigenic composition which might lead to erroneous identification upon casual serologic study. Edwards and his coworkers (8) (9) have reported a group of coliforms isolated from animals, principally in pathologic conditions, that are closely related biochemically to the paracolons of Stuart; they are, furthermore, antigenically interrelated and share certain of the somatic and flagellar antigens of the salmonellas; 14 types have been reported in the literature.

The importance of determining the antigenic composition of enteric organisms from the standpoint of diagnosis is becoming increasingly apparent. For example Bornstein, Saphra, and Daniels (10) found salmonella antigens in certain shigella strains; Saphra and Silberberg (11), Longfellow and Luippold (12), Wheeler and his coworkers (13) and others have reported observations that demonstrate continuous, interlocking antigenic complexities. In some instances the sharing of antigens extends even to organisms outside the enteric group as shown by Bornstein (14) and by Barnes and Wight (15).

A certain number of paracolons have been identified at this typing center; bacteriologic and serologic facilities are now such that those of clinical and epidemiologic importance may be more readily identified than was previously possible.

B. THE PROTEUS GROUP.

Although the members of this group have a wide saprophytic distribution in nature, it must be recognized that under certain conditions they may give rise to pathologic processes in man; the implication of certain species in cases of gastro-enteritis justifies their inclusion in the group of enteric pathogens and emphasizes the importance of accumulating further evidence.

Organisms of this group are found in large numbers in decaying animal protein and sewage, and are frequently found in the feces of human beings and lower animals; certain strains are commonly found on vegetables, probably as a result of contamination with sewage or manure.

According to Topley and Wilson, proteus bacilli are able to produce pathologic disturbances and are capable of massive multiplication in the intestinal canal; they have been isolated from cases of acute gastro-enteritis.

At present, four members of this group should be considered as potential enteric pathogens.

1. *Proteus vulgaris* undoubtedly has given rise to outbreaks of diarrhea (2) (16). The pathogenic significance of the strains of

serologic importance in rickettsial diseases is still obscure.

2. *Proteus mirabilis* has been identified here following isolation from sporadic and epidemic cases of mild to moderate gastro-enteritis under circumstances strongly suggestive of a causal relationship. It has recently been isolated from shrimp salad stated to have been implicated in a mild outbreak of "food infection" at a Naval station. Although the evidence is as yet inadequate, *Proteus mirabilis* must be thought of as a probable enteric pathogen.

3. *Proteus morganii* is a third species of the genus against which there is positive evidence for pathogenicity (2); it has been implicated in "food poisoning" (16). It has been identified several times here in cultures isolated from stools during outbreaks of gastro-enteritis.

4. The fourth member of this group that should be mentioned is *Proteus pseudovaleriei*. Littman (16) records it as having been found in the blood in "fever resembling typhoid." It differs from the other species in producing acid from lactose.

Evidence is accumulating that indicates the probable importance of members of the proteus group in enteric disease. It is urged that representatives of this genus isolated from food or stools during outbreaks of gastro-intestinal disturbances be forwarded in order that more conclusive data may be obtained.

C. THE PSEUDOMONAS GROUP.

The only member of this genus to which pathogenic properties have been ascribed is *Pseudomonas aeruginosa*, the species formerly designated as *Bacillus pyocyaneus*. The following excerpt from Topley and Wilson is pertinent.

It is widely distributed in nature, being found in water, sewage, and sometimes on the normal skin, particularly of the axilla and perineum. It is not infrequently found in wounds where it gives rise to "blue pus." It gives rise occasionally to suppurative processes and less often to generalized infection. Among the commonest manifestations are middle-ear suppuration in children, destructive lesions of the skin . . . and necrotic and ulcerative lesions of the alimentary mucosa . . . There is also reason to believe that the organism plays a part in some cases of infantile diarrhea. Infection may be primary or secondary, and is often acute and rapidly fatal. Sometimes it enters the blood stream and gives rise to a general infection. It is especially pathogenic in the tropics, where it not infrequently is responsible for typhoid-like infections and abscesses of the liver.

Pseudomonas aeruginosa has been encountered frequently enough to justify its inclusion among those organisms under suspicion as enteric pathogens. Following an outbreak of mild gastro-enteritis among Naval personnel it was readily found in

TABLE 1.—*Growth of gram-negative enteric bacilli on differential and selective media*

Group	Eosin-methylene blue agar	MacConkey's agar	Shigella-salmonella (S-S) agar	Desoxycholate agar	Desoxycholate citrate agar	Bismuth sulfite agar	Tetrathionate broth	Selenite-F broth	Bile-glycerin peptone broth
<i>Escherichia</i>	Large, flat, dark; metallic sheen	Pink to red; opaque	Inhibited; pink to red	Partially inhibited; pink to red	Inhibited; pink to red	Inhibited	Largely inhibited	Inhibited for 8 to 12 hours	Partially inhibited
<i>Aerobacter</i>	Large, mucoid, raised dark center, light periphery	Large, mucoid; pink to red; opaque	Inhibited; pink to red, or with pink center	Partially inhibited; mucoid; pink to red	Inhibited; pink to red	Inhibited	Largely inhibited	Inhibited for 8 to 12 hours	Partially inhibited
<i>Paracolon</i>	Medium to large; clear to pink or red; metallic sheen variable	Medium to large; clear, late pink to red	Largely inhibited	Occasionally translucent, becoming pink	Largely inhibited	Inhibited	Largely inhibited	Largely inhibited	Partially inhibited
<i>Salmonella</i> (including typhosa)	Medium to large; smooth, moist, translucent; colorless	Medium to large; transparent; colorless	Colorless; opaque, transparent or translucent	Colorless, or with brown center; irregular, thin edge	Colorless, or with brown center; translucent to bluish	Typhi brown to black, with smoky halo; others variable	Highly favorable; omit brilliant green for typhosa	Highly favorable for 8 to 12 hours	Favorable
<i>Shigella</i>	Small to medium; colorless, translucent	Medium to large; colorless, transparent, or translucent	Medium to large; colorless, opaque, transparent, or translucent	Medium; colorless, opaque	Colorless; opaque; even, smooth edge	Inhibited	Largely inhibited	Inhibited	Favorable
<i>Proteus</i>	Colorless; some spreading; translucent	Colorless; spreading	Colorless; opaque, transparent, translucent	Large; colorless; non-spreading; sometimes brown center	Large; colorless; non-spreading; sometimes brown center	Inhibited	Largely inhibited	Favorable	Not completely inhibited
<i>Pseudomonas</i>	Small, flat; colorless, translucent	Colorless	Yellowish, green, or black	Colorless, or olive color; brown center	Largely inhibited, or colorless; brown center	Inhibited	Partially inhibited	Favorable	Not completely inhibited
<i>Alcaligenes</i>	Colorless; translucent	Colorless	Colorless	Colorless; smooth	Usually inhibited	Inhibited	Partially inhibited	Inhibited	Favorable

one of the items on the menu of the meal involved; although statistically this particular article of diet was not the one incriminated, it is of interest that the organism was subsequently isolated from the stool of a food handler who helped prepare the food. A culture received from a unit in the South Pacific proved to be *Ps. aeruginosa*; it was isolated from the stool and the blood of a patient with "septic" symptoms. It promptly disappeared from the blood and the symptoms subsided following the administration of sulfadiazine. The organism was recently isolated from a dysenteric type of stool from a child with acute gastrointestinal disturbances; no other enteric pathogen was found.

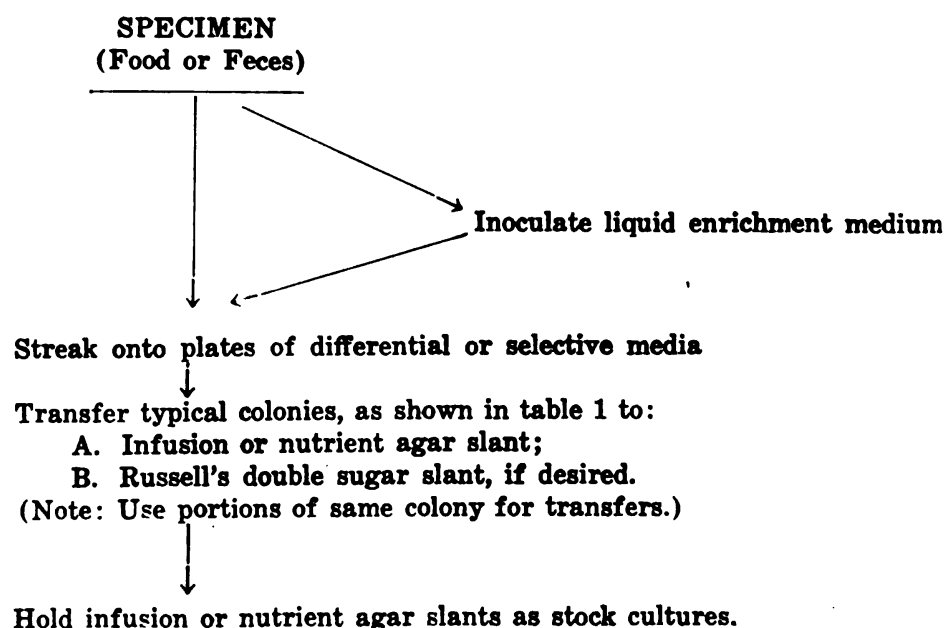
That the organisms are prevalent in at least certain South Pacific areas is indicated by a recent outbreak of otitis externa among Naval personnel in which the unit on duty established *Ps. aeruginosa* as the etiologic agent and found it readily in river and sea water used for bathing. A break in sanitary precautions, under such circumstances, might easily result in an outbreak of food infection.

It is of considerable importance that further epidemiologic and bacteriologic data be collected to determine more conclusively the status of *Ps. aeruginosa* as an enteric pathogen.

BACTERIOLOGIC PROCEDURES

In order to facilitate the recognition of members of the enteric group of pathogens listed here, a brief outline of recommended procedures is presented.

Bacteriologic Examination of Specimens for Enteric Pathogens



Observe Russell's double sugar slants after 18-to 24 hours' incubation for following results:

<i>Group</i>	<i>Butt</i>	<i>Slant</i>
<i>Escherichia</i> —aerobacter	AG	A
Intermediate—paracolon	AG	No change
<i>Salmonella</i>	AG	No change
<i>S. typhi</i> (<i>E. typhosa</i>)	A	No change
<i>Shigella</i>	A	No change
<i>Proteus</i>	AG	No change
<i>Pseudomonas</i>	A	No change
<i>Alcaligenes</i>	No change	Alkaline

Upon the basis of the reactions in double sugar agar, inoculate the appropriate media as shown in table 2; continue incubation of all fermentation media showing negative reactions for *at least two weeks*.

From the results of growth in media shown in table 2, a tentative diagnosis may be made after which indicated confirmatory tests should be applied.

The S-S agar is remarkably selective for the enteric pathogens, and desoxycholate agar only slightly less so; bismuth sulfite agar is inhibitory for all of the enteric group except certain of the salmonellas including *S. typhi*. These three plating media are used routinely for culturing stool and food specimens.

The tetrathionate broth is very satisfactory as an enrichment medium for selective growth of the salmonellas. Brilliant green in a final concentration of 1:100,000 will add to its value but will inhibit the *Salmonella typhi*; it is not suitable for the shigellas. The dehydrated tetrathionate broth base differs appreciably from the formula given by Kauffmann, so that if the dehydrated base is used, to each 100 ml. should be added 4 gm. of calcium carbonate (prepared chalk, U.S.P.) and 2 gm. of sodium thiosulfate and, in making the iodine solution, 4 gm. of iodine crystals (instead of 6 gm.) should be used; these alterations will make the formula conform to that of Kauffmann, which is to be recommended. From 2 to 4 gm. of a homogeneous sample, free from large particles, of the specimen should be inoculated into the broth; after 18- to 24-hours' growth plates of differential media should be streaked.

It should not be forgotten that mixtures of gram-negative rods in cultures from what appear to be single colonies may occur. If there is any reason to suspect the purity of cultures, it is far wiser to restreak on a medium such as MacConkey's in order that only pure cultures are used for the observations upon which diagnoses are to be made. Such a procedure actually results in a saving of time and may avoid discarding a mixed culture containing an important pathogen.

TABLE 2.—General differential biochemical characteristics of gram-negative enteric bacilli

Group	Fermentation media								Special purpose media						Remarks		
	Glu- cose	Lac- tose	Suc- rose	Mann- itol	Mal- tose	Dul- citol	Adon- itol	Sal- icin	Purple milk	Citrate medium	Gela- tin	Motility medium	Peptone solution			Glucose broth	
													H ₂ S	Indol		M.R.	V-P
Escherichia Aerobacter	AG	AG	AG	AG	AG	AG ±	AG ±	AG ±	AC	— +	— +	+	+	± —	— +	Some species variability	
Paracolon	AG	± slow if +	± slow if +	A G ±	A	.....	.....	±	.....	+	slow	+	to ±	—	±		Marked species variability
Salmonella	AG	—	—	.....	.....	AG	—	—	.....	.....	—	+	+	O↑↑↑↑*	.....	S. typhi anaerogenic	
Shigella	A	Gr. III +	—	A or —	.....	.....	—	—	.....	—	—	—	—	±	.....		Liberates NH ₃ from urea medium; AG in galac- tose and levulose
Proteus	AG	—	±	— *	.....	.....	.....	.....	.....	.....	.....	+	+	±	.....	Blue-green-yellow diffusible pigment	
Pseudomonas	A	—	—	→ Alkaline	→	—	—	—	Alk.; pepton- ized	.....	.....	+	+	—	.....		.....
Alcaligenes	—	—	→	Strongly alkaline	Strongly alkaline	→	—	—	—	.....	—	+	+	—	.....

* usually negative; +*, usually positive; ±, variable.

The urea medium mentioned in table 2 is extremely useful in helping to identify members of the genus *proteus*; the methods of preparation and use are given by Rustigian and Stuart (17).

It is of utmost importance that stool specimens be cultured as promptly as possible after passage; if more than 2 hours are likely to elapse before laboratory examination can be started, it is advisable to preserve the specimen in one or both of the solutions mentioned by Littman (16).

SUMMARY

There is evidence that certain members of the paracolon, *proteus*, and *pseudomonas* groups of microorganisms may be able, under certain conditions, to initiate outbreaks of gastro-enteritis, diarrhea, or dysentery-like disturbances. Information regarding the epidemiologic and bacteriologic data at hand has been presented. It is highly desirable to collect more material in order that a more precise appraisal of the evidence may be made. To further this objective, it is urged that cultures tentatively identified as belonging to any of the groups mentioned be forwarded to the Enteric Pathogen Laboratory at the U. S. Naval Medical School via official channels and that pertinent data be sent by the same routes. Official reports will be returned to the activity concerned as soon as is feasible.

REFERENCES

1. BARNES, L. A.: Identification of salmonella cultures. U. S. Nav. M. Bull. 41: 1184-1188, July 1943.
2. TOPLEY, W. W. C., and WILSON, G. S.: The Principles of Bacteriology and Immunity. William Wood & Co., Baltimore, 1938. pp. 381-382, 504-509, 535, 1250-1251.
3. STUART, C. A.; WHEELER, K. M.; RUSTIGIAN, R.; and ZIMMERMAN, A.: Biochemical and antigenic relationships of paracolon bacteria. J. Bact. 45: 101-119, February 1943.
4. STUART, C. A., and RUSTIGIAN, R.: Further studies on one type of paracolon organism. Am. J. Pub. Health 33: 1323-1325, November 1943.
5. STUART, C. A.; RUSTIGIAN, R.; ZIMMERMAN, A.; and CORRIGAN, F. V.: Pathogenicity, antigenic relationships and evolutionary trends of *Shigella alkalescens*. J. Immunol. 47: 425-437, November 1943.
6. ADAMS, J. W., JR., and ATWOOD, R. T.: Bacillary dysentery. Bacteriologic and clinical analysis of 251 cases occurring in Army camp. War Med. 5: 14-20, January 1944.
7. KAUFFMANN, F.: Die Bakteriologie der Salmonella-gruppe. Ejnar Munksgaards Forlag, København, 1941. pp. 288-302.
8. PELUFFO, C. A.; EDWARDS, P. R.; and BRUNER, D. W.: Group of coliform bacilli serologically related to genus salmonella. J. Infect. Dis. 70: 185-192, March-April 1942.

9. EDWARDS, P. R.; CHERRY, W. B.; and BRUNER, D. W.: Further studies on coliform bacteria serologically related to genus salmonella. *J. Infect. Dis.* 73: 229-238, November-December 1943.
10. BORNSTEIN, S.; SAPHRA, I.; and DANIELS, J. B.: Occurrence of salmonella antigens in dysentery bacilli. *J. Immunol.* 42: 401-404, December 1941.
11. SAPHRA, I., and SILBERBERG, M.: Taxonomy of salmonella-like coliform organisms; serological and cultural study. *J. Immunol.* 44: 129-133, June 1942.
12. LONGFELLOW, D., and LUIPPOLD, G. F.: Typhoid vaccine studies. VIII. Immunogenic relationship between V forms of *E. typhosa* and *S. ball-erup*. *Am. J. Hyg.* 37: 206-210, March 1943.
13. WHEELER, K. M.; STUART, C. A.; RUSTIGIAN, R.; and BORMAN, E. K.: Salmonella antigens of coliform bacteria. *J. Immunol.* 47: 59-66, July 1943.
14. BORNSTEIN, S.: State of salmonella problem. *J. Immunol.* 46: 439-496, June 1943.
15. BARNES, L. A., and WIGHT, E. C.: Serological relationship between pneumococcus type I and encapsulated strain of *Escherichia coli*. *J. Exper. Med.* 62: 281-287, August 1935.
16. LITTMAN, M. L.: Rapid identification of enteric pathogenic bacteria. *War Med.* 4: 31-56, July 1943.
17. RUSTIGIAN, R., and STUART, C. A.: Decomposition of urea by proteus. *Proc. Soc. Exper. Biol. & Med.* 47: 108-112, May 1941.



INTRAVENOUS USE OF NOVOCAINE

The idea of intravenous injection of local anesthetics is not new. In 1937 local anesthetic was administered intravenously in the treatment of tinnitus aurium. In 1940 at the Mayo's it was used for pruritus associated with jaundice. Their method was either to inject 20 c.c. of a 1 percent solution of procaine hydrochloride over a period of 2 minutes which gave 2-4 hours of analgesia or 1 gram in a litre over several hours which gave a much longer period of analgesia. Finally in December 1943 Major R. A. Gordon, R.C.A.M.C. reported a series of 10 cases of burns which had been given surgical treatment under intravenous procaine hydrochloride. He found that 1 gram in 500 cc. of normal saline administered over a period of 1 to 1½ hours was the most effective. He was able to do his preliminary treatment painlessly and have the patient comfortable for 10-12 hours postoperatively.—MCLACHLIN, J. A.: Intravenous use of novocaine as substitute for morphia in postoperative care; preliminary report. *Roy. Canad. Navy M. J.* 7: June 1944.

COLD HEMAGGLUTININS IN INFECTIOUS MONONUCLEOSIS

CLIFFORD L. SPINGARN

Lieutenant (MC) U.S.N.R.

JOHN P. JONES

Lieutenant (MC) U.S.N.R.

and

BERNARD OWRUTZKY

Chief Pharmacist's Mate U.S.N.R.

During a study of hemagglutination in acute infectious diseases, high titers of a cold agglutinin against type O human erythrocytes were detected in two patients with infectious mononucleosis. A perusal of the available literature on cold agglutination (1) (2) and infectious mononucleosis (3) revealed only one reported similar observation (4). In view of the recent interest in cold agglutination in the diagnosis of primary atypical pneumonia, it seemed worth while to report our observations on its appearance in infectious mononucleosis.

Methods.—The presence of cold hemagglutinins was determined by making serial dilutions of 0.1 cc. of freshly obtained blood serum in normal saline. To each 0.5 cc. of diluted serum 0.2 cc. of a 2-percent suspension of fresh thrice-washed group O red blood cells was added, making final dilutions of 1:14, 1:28, 1:56, etc. The tubes were shaken and refrigerated at 5° C. for 18 hours. The endpoint of the titer was determined by observing the presence of agglutinated O cells in the tubes with the low-power objective of the microscope after shaking each tube five times. The serum dilution in the last tube showing agglutinated cells indicates this point. If agglutination occurred, the cell suspensions were incubated at 37° C. for 60 minutes to observe the effect of this temperature.

Sheep cell hemagglutinin was tested for in freshly drawn or stored serum inactivated at 56° C. for 30 minutes. Serial dilutions were made as previously described. Two-tenths cubic centimeter of a 2-percent suspension of fresh, thrice-washed sheep cells was added to each tube and the tubes were incubated at 37° C. for 2 hours. The endpoint was determined as described in the previous paragraph. The tubes were then refrigerated for 16 hours at 5° C. to determine the "cold sheep cell" agglutinin titer, and were again placed in the incubator at 37° C. for 1 hour.

TABLE 1.—Comparison of cold (5°C.) and warm (37°C.) hemagglutinin titers in infectious mononucleosis and in primary atypical pneumonia

Disease	O cell agglutinin titer		Sheep cell agglutinin titer	
	5° C.	37° C.	5° C.	37° C.
Infectious mononucleosis				
1	1:3,584	0	1:3,584	1:1,792
2	1:224	0	1:896	1:448
Primary atypical pneumonia				
1	1:14,336	0	1:56	0
2	1:7,168	0	1:28	0
3	1:3,584	0	1:28	0
4	1:3,584	0	1:56	1:56
5	1:1,792	0	1:56	1:28
6	1:1,792	0	1:28	0
7	1:896	0	1:56	0
8	1:896	0	1:56	1:14

Results.—The results of the determination of hemagglutinin titers under the above stated conditions in 2 cases of infectious mononucleosis are compared with those in 8 cases of primary atypical pneumonia (table 1) and in 10 normal individuals (table 2).

TABLE 2.—Cold (5°C.) and warm (37°C.) hemagglutinin titers in ten normal individuals

Control	O cell agglutinin titer		Sheep cell agglutinin titer	
	5° C.	37° C.	5° C.	37° C.
1	0	0	1:56	1:14
2	0	0	1:28	0
3	1:14	0	1:112	0
4	0	0	1:112	0
5	1:56	0	1:28	0
6	1:28	0	1:56	0
7	0	0	1:56	0
8	0	0	1:112	0
9	0	0	1:56	0
10	0	0	1:28	0

In the patients listed in table 1, a hemagglutinin against human type O cells was active at 5° C. and inactive at 37° C. The sera of the 2 cases of infectious mononucleosis contained a sheep cell agglutinin which was active at 37° C. Low titers of this agglutinin were also detected at 37° C. in 3 cases of primary atypical pneumonia. When all these sera were tested for sheep cell agglutinin at 5° C., the activity, if present at 37° C., usually increased slightly. Moreover, those sera that contained no active sheep cell agglutinin at 37° C., did so in low titer at 5° C.

COMMENT

These findings indicate that infectious mononucleosis should be

added to the list of diseases in which a cold hemagglutinin may appear in the serum in high titer (1). They support our working hypothesis that the marked activity of the hemagglutinins studied is dependent on an increase in the concentration of some normal serum constituents. The latter may occur in response to infections with a variety of agents and may be related to the tissues involved.

Since this report was submitted, the authors have detected cold hemagglutinins in high titer (1:896, 1:1,792 and 1:3,584) in five additional cases of infectious mononucleosis.

REFERENCES

1. STATS, D., and WASSERMAN, L. R.: Cold hemagglutination; interpretive review. *Medicine* 22: 363, December 1943.
2. TURNER, J. C.; NISNEWITZ, S.; JACKSON, E. B.; and BERNEY, R.: Relation of cold agglutinins to atypical pneumonia. *Lancet* 1: 765-769, June 19, 1943.
3. BERNSTEIN, A.: Infectious mononucleosis. *Medicine* 19: 85-159, February 1940.
4. BELK, W. P.: Minor hemagglutinins; study of single human blood containing autoagglutinin, heteroagglutinins and hemolysins, and rouleau-forming substance. *J. Lab. & Clin. Med.* 20: 1035-1042, July 1935.



BACTERIOSTATIC AGENT FOR SPINAL FLUID SPECIMENS

Spinal fluid specimens transported through the mail to a central laboratory for serologic testing not infrequently display evidence of gross bacterial contamination upon arrival. The proportion of specimens thus rendered unsuitable for testing is appreciable during the entire year but the loss becomes marked during the warm months.

A tube containing 1 mg. of merthiolate substance has been found efficacious in curtailing bacterial growth in spinal fluid specimens transported through the mail for serologic testing.—HARRIS, A., and MAHONEY, J. F.: Merthiolate as effective bacteriostatic agent in spinal fluid specimens. *Ven. Dis. Inform.* 25: 46, February 1944.

TREATMENT OF MARGINAL PARADENTOSIS IN NAVAL PERSONNEL¹

JAMES L. BRADLEY
Lieutenant Commander (DC) U.S.N.
and
PERRY A. RATCLIFF
Lieutenant (DC) U.S.N.

The Navy at one time rejected recruits because of periodontal disease; but with the expansion necessitated by war, this regulation has been relaxed. As a result there is a greatly increased number of persons needing oral treatment. The dental officer faces an entirely different problem from the civilian dentist when he undertakes periodontal treatment (1). The period that the dental officer has in which to treat the patient is indefinite, because the officer or the patient may receive sudden transfer orders. The dental officer, moreover, cannot refer the patient to a periodontist.

Approximately 90 percent of all cases of periodontal disease are of the marginal variety, from local causes (1) (2). This form responds most readily to treatment.

Marginal paradentosis is gingival disease resulting from local etiologic factors. Gottlieb (3) calls it filth pyorrhea, characterized by gingival inflammation and pocket formations of varying depths which progress from the gingival crest toward the alveolar crest. This differs from normal gingival tissue, which has a light pink color, good tissue tone, and a depth of from 1 mm. to 2 mm. from the crest to the point of epithelial attachment.

ETIOLOGY

Sorrin (1) states that there is no single etiologic factor. The disease is the result of two or more factors, one of which causes lowered resistance of the involved tissues and this permits a secondary factor, bacterial invasion, to gain a foothold.

Any one factor or any combination of factors may cause the disease. Thoma (4) lists them as (1) mechanical irritants, (2) food impaction, (3) functional insufficiency, (4) occlusal overburdening or strain, and (5) infection.

Mechanical irritants.—Under mechanical irritants, Thoma lists calcareous deposits, irritations of loose crown margins and over-

¹ From the U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md.

hanging fillings, bands, and incorrect toothbrushing. He also adds that calculus introduces not only a mechanical irritation, but also infection, because it is a carrier of bacteria.

Calculus, which is the main source of gingival irritation, is the result of the calcification of organic matter deposited upon the teeth (5). This deposit is composed of desquamated epithelial cells of the oral mucosa, food debris, salivary mucin and bacteria. The formation of calculus is caused by the calcification and hardening of this film by the deposition of calcium salts from the saliva.

Food impaction.—Food impaction (6) may be due to lack of approximal contact of the teeth, malposition of the teeth and jaws, or previous recession of the gingival tissues. It causes inflammation, which in turn lowers the resistance of the tissues and invites bacterial invasion.

Functional insufficiency.—Functional insufficiency may result from lack of exercise in mastication, or it may occur as a partial insufficiency due to a malocclusion or to teeth with no antagonists. This condition affects only certain areas of the jaws. There is a weakening of the supporting structures of the teeth resulting in lowered resistance of the gingival tissues.

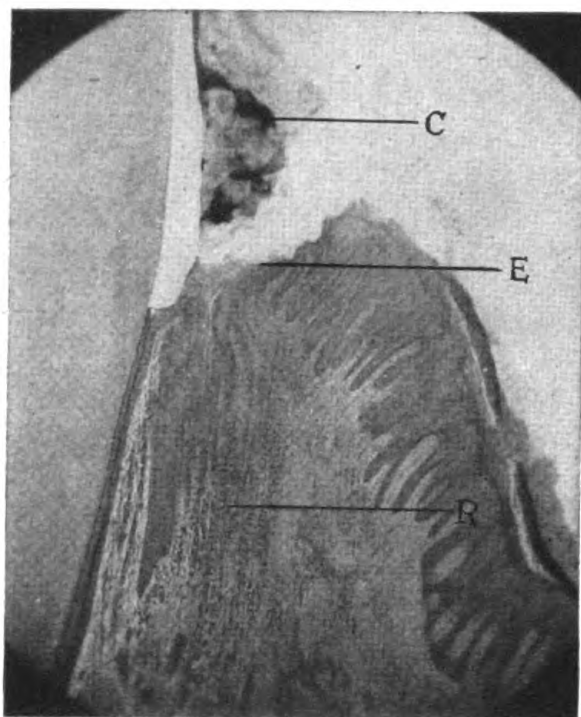
Traumatic occlusion.—Traumatic occlusion (7) (8) may be caused by malocclusion, faulty restorations, or the loss of teeth. Sorrin states that trauma is a factor in as many as 85 percent of all cases.

Infection.—Infection may be primary or secondary. Marginal paradentosis resulting from Vincent's infection is an example of the primary type; however, most infection is from a secondary invasion of bacteria into tissues the resistance of which has been lowered by other factors.

Systemic disorders.—Although marginal paradentosis is the result of local etiologic factors, systemic disorders, such as malnutrition, allergy, diabetes, nephritis, and any of the blood dyscrasias, may be predisposing or complicating.

A deficiency of ascorbic acid or vitamin C manifests itself in bleeding of the gingivae and even loosening of the teeth. The deficiency produces an inability of the connective tissue to withstand functional stress, and periodontal lesions result.

Wolbach and Howe (9) have shown that the earliest demonstrable sign of vitamin A deficiency in rats and guinea pigs is an atrophy with substitution of keratinized epithelium. Mellanby (10) showed that vitamin A deficiency predisposes to subgingival epithelial hyperplasia and its subsequent loss of resistance to bacterial invasion.



1. Photomicrograph showing effect of salivary calculus on gingival papilla: **C**, calculus; **E**, destruction of marginal epithelium; **R**, round cell infiltration.

Tishler (11) reports that of 101 cases of periodontal disease studied, 63 percent showed a vitamin A deficiency and 35 percent showed a vitamin C deficiency.

PATHOLOGY

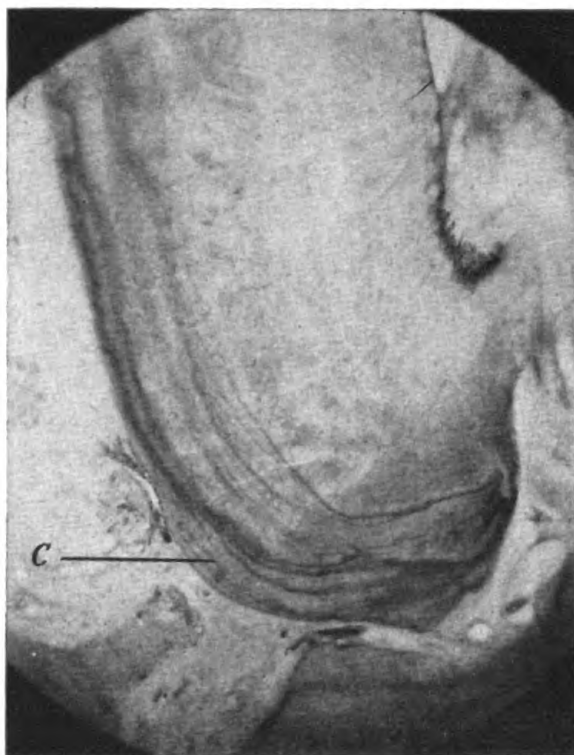
With the deposition of small amounts of salivary calculus there is an incipient desquamation of the epithelium at the gingival crest. There is loss of keratinization as the tissue is progressively irritated. Even at this stage when there is no change in the location of the epithelial attachment, there is infiltration of round cells into the underlying interstitial tissues.

As the irritant calculus accumulates the tissues continue to degenerate. Greater areas of hornified epithelium are lost. The capillaries become enlarged, and round cells accumulate in large numbers. The crest of alveolar bone is resorbed at the point of irritation.

Serumal or subgingival calculus differs from salivary or supra-gingival calculus only in the location at which it attacks the gingival epithelium. In early stages the epithelium will be fairly well keratinized at the crest, whereas desquamation occurs in the deeper tissues (fig. 1).

As the disease progresses there is a continued desquamation of epithelium and increased round cell infiltration. The gingival papilla becomes hyperemic and edematous. The gingival attach-

2. Photomicrograph showing effect of abnormal stress upon periodontal membrane and cementum; **C**, thickening of cementum.



ment recedes toward the root apex, and the pocket is lined with epithelium.

When sufficient alveolar crest has been lost, the remaining supporting tissues undergo a functional change to fulfill an increased demand on them. The periodontal membrane becomes enlarged and secondary cementum is deposited on the root surfaces according to the degree of occlusal stress (fig. 2).

In all pockets the epithelium tends to grow down along the cementum. This proliferation precedes the destructive process, so that the pocket is continuously lined with epithelium. As the disease advances the submucosa becomes increasingly congested, accompanied by round cell infiltration. Both lymphocytes and plasma cells are present. In the deep part of the corium, transverse periodontal fibers are always present. As the old fibers are destroyed, new fibers are formed above the crest of the bone to take their place.

Bone changes are always secondary and are the result of the local irritation and infection. The cortical plate is opened and the underlying bone assumes a jagged or pitted appearance. The lacunae are resorbed by osteoclasts (4) rather than by necrosis.

CLINICAL APPEARANCE

As etiology and pathology would indicate, when a patient with

marginal paradentosis presents at the dental dispensary, poor oral hygiene and gingival inflammation are seen on examination.

By far the most common irritant is calculus. There is a general loss of tissue tone in the affected areas. Hyperemia and edema of the tissues vary in severity to the extent that many cases are diagnosed erroneously as Vincent's infection.

Roentgenologic examination shows atrophy at the alveolar crest. The extent and location of the bone loss are always in direct relation to the irritant factors; however the roentgenogram does not show the relation of the alveolar crest to the epithelial attachment.

In most cases the complicating factor is a malocclusion. There may be an extreme overjet with marginal paradentosis of the anterior teeth, or malocclusion of the posterior teeth owing to a loss of a first molar which resulted in food-packing against the gingival tissues. Any one of the many varied occlusal relations may become an etiologic factor.

In an investigation of 223 cases suggesting Vincent's infection made at the U. S. Naval Dental School, 97 were finally diagnosed as marginal paradentosis. In these 97 cases, two-thirds of the patients had some malposition of the teeth.

TREATMENT

The patient must be cooperative and diligent in maintaining good oral hygiene. To this end it is of the utmost importance for the dental officer to teach a correct technic of oral hygiene to his patients. Without this, failure may be expected in any type of treatment.

The second requisite is a thorough diagnosis to determine all the etiologic factors before any attempt is made toward pocket elimination. Regardless of the condition of the tissues and the success of pocket elimination, recurrence is inevitable if the etiologic factors remain.

Each case must be thoroughly studied. The location of any overhanging margins of old restorations must be corrected. Each contact point must be checked with dental floss to locate possible points of food impaction. Good restorative dentistry is essential to the health of the gingival tissues.

After condylar registrations have been obtained, study models are mounted on an anatomic articulator in centric relation, to study possible occlusal trauma. Lateral and protrusive excursions of the mandibular cast will demonstrate cuspal interference. Marking the occlusals of the teeth with articulating paper will demonstrate those areas receiving the greatest stress. Placing

the tip of the index finger on the external surfaces of the teeth while the patient grits his teeth will show the extent of mobility developed by trauma.

The relief of trauma is difficult. Its correction requires that frequent checkups follow occlusal grinding. Osseous tissue must be regenerated and periodontal membrane stability restored before treatment can be considered successful. In many instances it may be necessary to have patients checked at subsequent activities.

A history of the diet is important because of the frequency with which vitamin deficiencies may affect Naval personnel. Unless the history is conclusive, it is well to make a vitamin determination test. The medical officer should be consulted concerning treatment in these cases.

The extent to which the disease has progressed will in part determine the treatment of choice. Full mouth roentgenographic examination is an aid in determining the extent of bone loss. By the use of a periodontal membrane marker, the depth of the pockets can be ascertained.

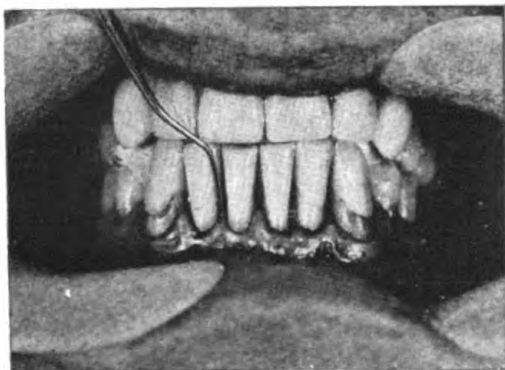
Any of the accepted methods for pocket elimination will achieve the same result (12), differing only in the length of time consumed. Because Naval activity limits the time available for treatment, the time element is important in determining the method to be used.

The so-called conservative methods of treatment are slowest. All the causative factors are removed. A thorough prophylaxis is given and the highest state of oral hygiene that can be attained is established.

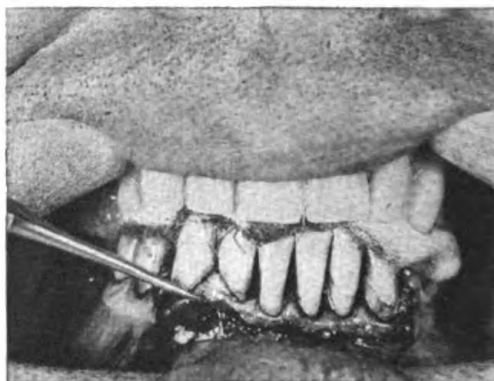
1. An 8-percent solution of zinc chloride is prepared. Cotton pledgets containing the solution are packed into the embrasures of the affected areas, pressure being created on the underlying gingival tissues. There should be a blanching of the tissues from the pressure of the pack. The pack is left in place for 10 minutes before removal.

2. The patient is instructed in interproximal massage by the use of round toothpicks or rubber tips. Careful mechanical pressure should be applied against the gingival tissues with the crest crowded toward the point of epithelial attachment. This stimulates hornification of the epithelium by increasing the circulation of blood to the area. Interproximal stimulation is an adjunct to proper toothbrushing. When pockets are only 2 mm. or 3 mm. in depth, this procedure will give excellent results without consuming too much time.

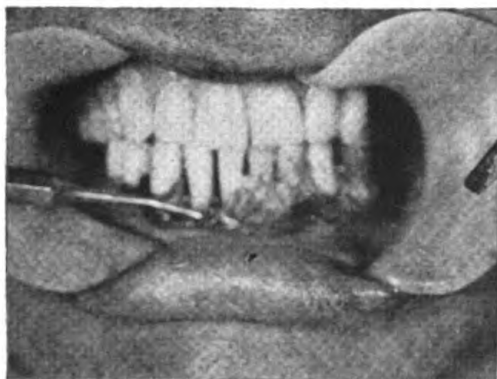
3. If the pockets are deeper, surgery will be necessary to save



3. Depth of pocket is marked on labial surface of soft tissue.



4. Tissue incised down to mark that shows depth of pocket. Soft tissue is completely eradicated.



5. Inflammatory granulations removed by means of spoon excavators, and rough, irregular surfaces of bone smoothed by means of enamel hatchets. Interproximal areas packed with 8-percent solution of zinc chloride for approximately 5 minutes. This astringent is used to remove small excess granulations and to aid in establishment of a good blood clot covering the alveolus.



6. Gauze removed; area irrigated with warm salt solution and packed with a zinc oxide and eugenol dressing.

time. Because "electrocoagulation has a tendency to cause an increased inflammatory process in the underlying connective tissue and alveolar crest, thereby tending to delay the healing . . ." (13) and the surgical flap operation has a slower recovery, gingivectomy by the use of the knife is preferable.

The depth of the pockets is measured with an explorer or a periodontal membrane marker and marked on the external sur-

face of the gingivae (fig. 3). With these markings as a guide, the tissues are excised at this line (fig. 4). The excess soft tissue is completely eradicated to the point of epithelial attachment.

The removal of this tissue will expose retained calculus deposits and inflammatory granulation tissue (fig. 5) which are removed by spoon excavators. The irregular surfaces of the exposed bone are smoothed with chisels and enamel hatchets.

4. The entire area should be thoroughly irrigated with normal salt solution and packed with 8-percent zinc chloride for approximately 5 minutes. The zinc chloride will help in the removal of any remaining granulation tissue and will aid in establishing a good blood clot over the alveolar bone (fig. 5).

5. The area is again irrigated with normal salt solution, and small packs of zinc oxide and eugenol paste are placed in the interproximal spaces to act as a palliative dressing (fig. 6).

6. In from 2 to 5 days the dressing should be changed. The mouth should be irrigated with normal saline solution. During

7. Appearance of mandibular gingival tissue 6 weeks after operation.



the ensuing period of from 10 to 14 days, granulation tissue will cover the denuded bone and then be replaced by healthy gingival tissue.

7. Proper massage by the patient will encourage good tissue tone and prevent proliferation of the new gingival papillae.

CONCLUSIONS

1. Patients for whom periodontal treatment is contemplated must be carefully instructed in proper oral hygiene to assure cooperation.

2. A thorough examination is essential to determine the cause.

3. All causative factors must be removed if there is to be no recurrence of the disease.

4. Successful treatment of shallow pockets can be accomplished by conservative methods.

5. Successful treatment of deeper pockets can be accomplished best by gingivectomy.

REFERENCES

1. SORRIN, S.: Periodontal disease; study in diet and statistics. *Dental Cosmos* 71: 695-701, July 1929.
2. BLACK, G. V.: *Operative Dentistry*. Medico-Dental Publishing Co., Chicago, 1920.
3. GOTTLIEB, B.: Formation of pocket. *J. Am. Dent. A.* 15: 462-475, March 1928.
4. THOMA, K. H.: *Oral Pathology*. The C. V. Mosby Co., St. Louis, Mo., 1941.
5. KRONFELD, R.: *Histopathology of the Teeth and Their Surrounding Structures*. Lea & Febiger, Philadelphia, 1939.
6. HIRSCHFELD, I.: Food impaction. *J. Am. Dent. A.* 17: 1504-1528, August 1930.
7. LEONARD, H. J.: Treatment of periodontoclasia. *Dominion Dent. J.* 39: 337-345, January 1928.
8. HOUSE, M. M.: Traumatic occlusion as factor in periodontia; its detection and correction. *J. Am. Dent. A.* 13: 625-634, May 1926.
9. WOLBACH, S. B., and HOWE, P. R.: Epithelial repair in recovery from vitamin A deficiency; experimental study. *J. Exper. Med.* 57: 511-526, March 1933.
10. MELLANBY, M.: Experiments on dogs, rabbits and rats, and investigations on man which indicate power of certain food factors to prevent and control dental disease. *J. Am. Dent. A.* 17: 1456-1480, August 1930.
11. TISHLER, B.: Diet analysis of 101 periodontoclasia cases. *J. Am. Dent. A.* 16: 1037-1046, June 1929.
12. KAPLAN, H., and MANN, J. B.: Comparative study of several methods for treatment of pyorrhea alveolaris. *J. Am. Dent. A.* 29: 1471-1483, August 1942.
13. COOLIDGE, E. D.: Periodontal symposium. *Illinois Dent. J.* 12: 3-10, January 1943.

A MODIFIED APICOECTOMY TECHNIC¹

INDICATIONS AND APPLICATION IN THE FIELD

CHARLES M. MOORE
Lieutenant (DC) U.S.N.R.

Replacement of single anterior teeth by crown and bridge prosthesis while on foreign duty and in the field is not practical. Tooth conservation has been possible through a modified, combined apicoectomy and root canal operation for periapically involved teeth. In this type of elective operation, military dentistry introduces additional considerations in treatment planning, i.e., the importance of saving time and the fact that there is little or no need for case selection because Naval patients have high reparative and phagocytic powers. Root resection in selected cases is not a new operation, and has many variations. The one-sitting technic herein described is based on accepted surgical principles; it does not necessitate an extensive armamentarium and it does save time. Its routine use, therefore, has been found particularly applicable in the field.

INDICATIONS

1. Retained teeth when treated by the modified apicoectomy to be described not only retain their masticatory functions but also act as space-maintainers until the patient can, if necessary, receive specialized crown and bridge service after his return to a base hospital or to the United States.

2. In cases of pulpless teeth in which periapical disease is not roentgenographically evident, the apicoectomy acts as a prophylactic measure in preventing abscess formation by insuring a completely apically-sealed canal filling. Focal infection not detectable by roentgenographic examination may be present. Apicoectomy will eliminate such infection.

3. The technic obviates the need of eventually using comparatively weak single-rooted teeth as abutments for replacements.

4. The esthetic advantage of retaining anterior teeth has morale value even in the field.

5. In anterior abutment teeth, the technic permits the possible retention of bridges which would otherwise have to be removed.

6. Apicoectomy corrects improper root canal filling done prior

¹ Patients were treated while on foreign duty with a Naval construction battalion.

to enlistment which may be an actual or potential source of periapical disease.

7. It permits the retention of teeth after root fracture when approximately two-thirds of the root remains intact.

Contraindications to apicoectomy for patients in the field are few and include only those obvious instances of exceptionally extensive periapical bone pathosis, or cases in which there is not sufficient supporting bone for tooth retention.

Diagnostic means are often eliminated in the field. X-ray units and electric pulp-testing facilities are not always available; therefore particular attention must be given to the following diagnostic factors: Careful history-taking with emphasis on the specific nature, onset, and duration of pain symptoms; thorough examination, including observation, questioning, instrumentation, palpation, and percussion. Transillumination is helpful, especially when x-ray facilities are not available. Thermal tests may be made instead of using a pulp-testing apparatus.

PREOPERATIVE PROCEDURE

The acute condition of the tooth and its investing tissues must be reduced, oral sepsis corrected, and caries treated. A roentgenogram should be taken, if possible, to determine the length and position of the root, location, and extent of the apical pathologic process. Apprehensive patients are given a sedative. If necessary, traumatic occlusion is treated. In many cases a prophylactic reduction of occlusal stress is desirable. Asepsis must be maintained in so far as oral conditions permit.

Local procaine hydrochloride periosteal infiltration is the anesthetic of choice. It is important that the anesthetic solution does not contain too much vasoconstricting agent. This might prevent sufficient bleeding for clot formation in the window area. A 2-percent procaine hydrochloride solution with epinephrine 1:50,000 is recommended. In the labial injection of the maxillary incisors, it is well to infiltrate on both sides of the median line in order that interlacing nerve filaments from the opposite side be anesthetized.

OPERATION

Pulp extirpation.—The contents of the pulp chamber and canal are grossly removed and the canal is slightly enlarged by means of rat-tail files and reamers.

Incision and flap.—In the maxilla a large curved incision is made extending from the mucobuccal fold downward and mesially just above but not involving the gingivae (fig. 2). The approxi-

mate width may be governed by two imaginary vertical lines, each extending from the distal surface of the tooth on each side of the selected tooth. The mucoperiosteum is carefully retracted with a large periosteal elevator.

This type flap is preferred because:

1. The larger flap gives better visibility and accessibility.
2. There is more bony support for the replaced flap, thus aiding coaptation.
3. By having the concavity of the maxillary incision upward, gravity aids replacement and fewer sutures are needed. The flap is benefited by the blood supply from the mucobuccal region.
4. By not involving the gingivae, coaptation is facilitated and fewer sutures are needed.

Bone window.—Surgical burs, osseous chisels, or rongeurs may be used in preparing the bone window. In cases in which the bony plate was too heavy for rongeurs, burs have been preferred because they were found more readily controlled and time-saving. No deleterious effects, such as "bone burns" have been evident.

Whenever possible, the apical sac is dissected out en masse. The area is thoroughly curetted, and the root apex is removed with a bur or chisel.

Small spoon excavators and large round burs have been found helpful in cleaning and trimming the area.

After all sharp edges have been removed, the area is irrigated and sterile gauze packed into the window.

Root canal filling.—The walls of the pulp canal and chamber are freshened and phenolized. A chlora-percha, gutta-percha filling, with a root canal sealer, is well condensed in the canal to permit extension through the apical end. The coronal end is sealed with silicate. The gauze is removed. A thorough apical seal is obtained by cutting off the excess filling and searing with a hot instrument.

The window area is irrigated with a mild antiseptic and the entire operative area dusted generously with a powdered sulfonamide, preferably microcrystalline sulfathiazole and sulfanilamide in equal parts. The chip blower is helpful in distributing the crystals equally. In rare instances, it is necessary to curette the walls of the window area lightly in order to promote the necessary bleeding for clot formation. From one to three sutures are usually sufficient to close the flap. There is no need for drains of any kind.

Postoperative sedation has rarely been required. The patient is instructed regarding the usual postoperative use of an ice bag or cold compresses and warm saline irrigations. The tooth is

rechecked for traumatic occlusion, and the patient is advised to be somewhat careful of the tooth in mastication during the primary healing period. If possible a roentgenographic check is made. In the average case after 24 hours of recommended light duty the patient is able to resume his normal activities without discomfort. After 5 days the sutures are removed.

PROGNOSIS

Difficulties in making long-range follow-up examinations have not permitted the compilation of statistics. It is accepted that the success of an apicoectomy depends on the success of the primary healing. This was borne out when all patients examined 1 year after operation showed complete bone regeneration.



1. (Case 1). Preoperative roentgenogram showing radiolucency indicative of periapical osteitis involving two teeth. Note overextended root canal filling in central incisor and large silicate restoration in lateral incisor.

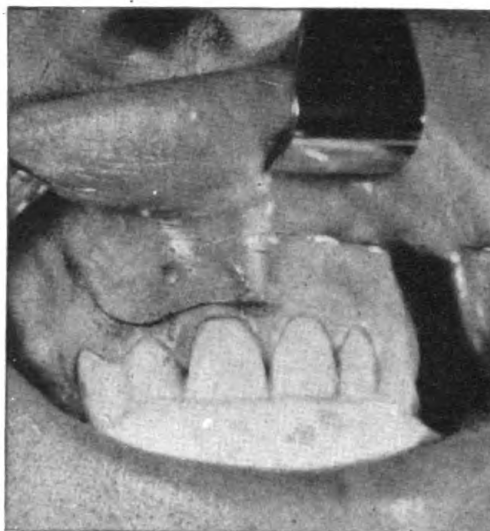
CASE REPORTS

Case 1 (figs. 1-7).—A seaman, first class, a crane operator, aged 22, reported to the dental clinic because of an abscess and pain in the upper right central and lateral incisors elicited by biting pressure.

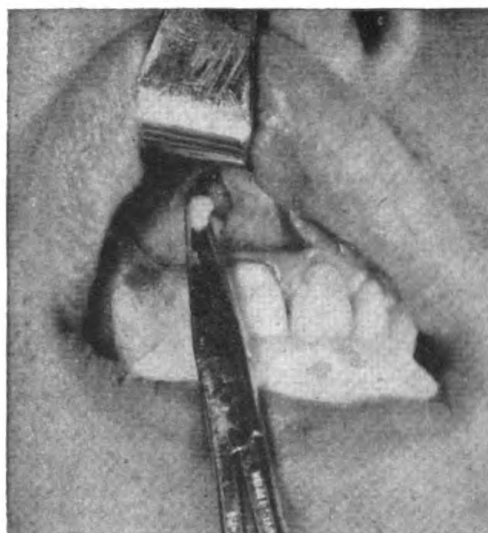
History.—The patient revealed that the fistulous opening was first noticed 6 months previously and recurred periodically. The pulp had been removed from the central incisor prior to enlistment 13 months before, at which time the dentist had warned him that there might be a reaction.

Examination.—No inflammatory symptoms, oral sepsis, or caries were found. The right central and lateral incisors were normally aligned, the central having a well made porcelain jacket crown and the lateral a large mesial silicate restoration. A small labial fistulous opening was present in the apical area. Palpation and percussion were painful. Roentgenographic

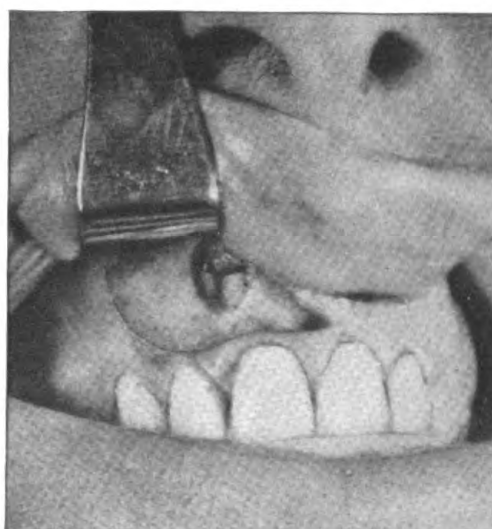
2. (Case 1). Incision for flap.

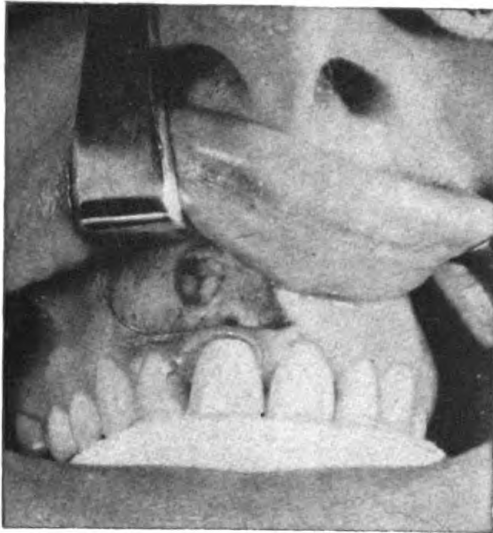


3. (Case 1). Flap retracted showing process of enucleating cystic mass through bone window with aid of hemostatic forceps.

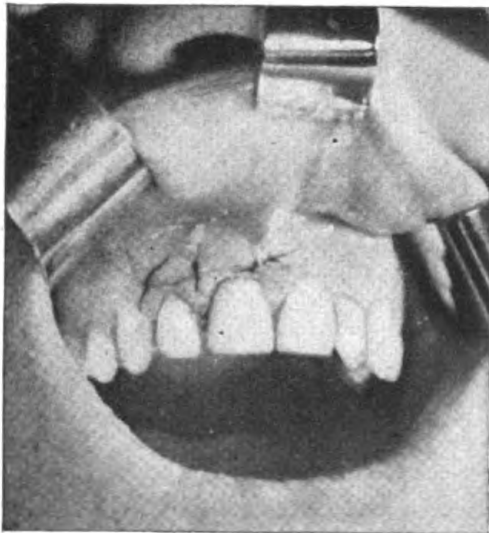


4. (Case 1). Bone window after double apicoectomy. Note overextended root canal filling in right lateral incisor.





5. (Case 1). Bone window after removal of over-extended root canal filling and application of sulfonamide.



6. (Case 1). Coaptation of flap with three sutures.



7. (Case 1). Postoperative roentgenogram. Apexes removed. Complete root canal fillings.

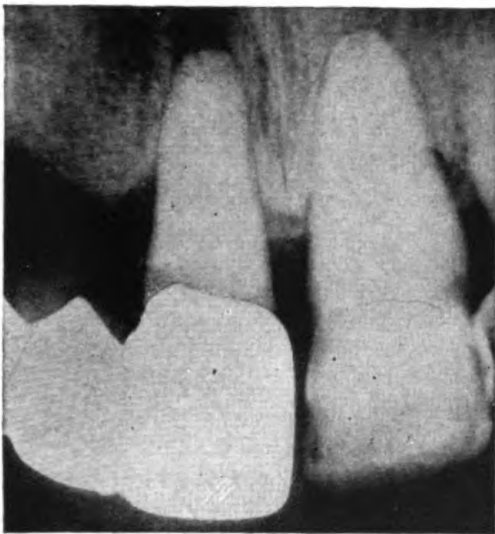
examination (fig. 1) showed a radiolucent area involving both apices. There was no response to thermal change tests.

Diagnosis.—A diagnosis of chronic (recurrent acute) periapical osteitis was made.

Treatment.—Apicoectomy of both teeth and correction of the faulty root canal filling in the lateral incisor were done in one operation.

Postoperative course.—Twenty-four hours' light duty was recommended, and the patient was instructed as to the usual postoperative care. No edema, unusual pain, or soreness followed.

Case 2 (figs. 8 and 9).—A shipfitter, second class, aged 42, reported to the dental clinic because of sensitivity of the anterior teeth, especially when eating. The patient stated that this condition had been present for 6 months and that the sensitivity periodically increased.



8. (Case 2). Preoperative roentgenogram. Periapical involvement of central incisor serving as abutment for a two-tooth bridge.



9. (Case 2). Postoperative roentgenogram following removal of infected area, apicoectomy, and root canal filling.

Examination.—No acute inflammatory symptoms were evident. There was a gold bridge, which had been in place for 6 years, replacing the left lateral and cuspid. The left central and first bicuspid were used as abutments. Palpation, and percussion of the bridge were slightly painful. Roentgenograms of the abutments revealed a radiolucent area indicating a periapical osteitis of the central incisor (fig. 8).

Treatment and course.—In order to save the tooth and the bridge, an apicoectomy and root canal filling were performed with the bridge in place. An amalgam restoration was used to seal the lingual opening into the canal. Postoperative discomfort was negligible and primary healing was uneventful.

COMMENTS AND CONCLUSIONS

1. Military exigencies in the field make it necessary to supplant the traditional technic of protracted root canal therapy with

eventual apicoectomy; or root-filling operations requiring several visits, with repeated roentgenologic checks and bacteriologic tests. A simplified technic requiring only one sitting is offered here which differs from the usual method chiefly in that the apicoectomy is done prior to the root canal filling.

2. Numerous flap designs have been advocated, but the flap herein illustrated is preferred.

3. The use of burs or chisels in the preparation of the bone window and for root resectioning is controversial; however in this the bur was found to be preferable.

4. The local use of a sulfonamide and the fact that patients are selected no doubt contribute to more favorable prognoses.

5. The operation is based on surgical principles, is reliable, obviates the need for comprehensive chemotherapy, and does not require an extensive armamentarium.



A NONHEMOLYTIC STREPTOCOCCUS AND PRIMARY ATYPICAL PNEUMONIA

Streptococcus MG, a nonhemolytic streptococcus, was isolated from the lung tissues of 6 of a total of 8 patients who died of primary atypical pneumonia, and was not obtained from the lung tissues of 6 patients who died of other causes. It was isolated from the sputum or throat swabs of 53 of a total of 97 patients with primary atypical pneumonia, and 20 of a total of 82 patients with other acute infectious diseases, as well as 7 of a total of 57 normal persons. It was found that 67 percent of 193 patients with primary atypical pneumonia developed during convalescence antibodies directed against streptococcus MG.

The significance of this nonhemolytic streptococcus in relation to primary atypical pneumonia is not yet clear. There appear to be a number of possible explanations which must be considered separately: First, it seems possible that the observed serological reactions might be the result of a coincidental antigenic relationship between this nonhemolytic streptococcus and some other agent, perhaps a virus, which is itself the causative agent in primary atypical pneumonia; second, it seems possible that this nonhemolytic streptococcus might occupy the role of secondary invader in primary atypical pneumonia; and third, it seems possible that this nonhemolytic streptococcus, either alone or in concert with some other infectious agent, might be primarily involved in the pathogenesis of primary atypical pneumonia. The available evidence is not sufficient to warrant the acceptance of this hypothesis at the present time, although the results of this study suggest paths for further explanation.—THOMAS, L.; MIRICK, G. S.; CURNEN, E. C., JR.; ZIEGLER, J. E., JR.; and HORSFALL, F. L., JR.: Studies on primary atypical pneumonia. II. Observations concerning relationship of nonhemolytic streptococcus to disease. To be published.

LOW INCIDENCE OF MALINGERING AMONG NAVY DRAFTEES

DANIEL H. HARRIS
Lieutenant H-V(S) U.S.N.R.

Each new recruit at a Naval training station undergoes a brief psychiatric screening interview as part of the comprehensive medical examination he receives before being issued his uniforms and equipment and sent to "boot" training. If any psychiatric, psychologic, or neurologic defects or apparent defects are disclosed during this screening interview, the recruit is held over for a period of observation and investigation which may, and often does, result in his being discharged from the service. This procedure has been described in the literature (1) (2) (3) (4).

With personnel between the ages of 18 and 37, inclusive, being drafted as they have been since early in 1943, the question arises as to whether there is a tendency for such inductees to exaggerate their somatic aches and pains, nervousness and so on, or even to be tempted to malingering, during the screening examination. It might be conjectured that if any such tendency existed, one might expect it to be strongest at the upper and lower extremes of the draft ages, that is, among those who just missed being draft-exempt because of age.

A simple statistical analysis designed to answer, to some extent, these questions was undertaken. It was felt that any positive findings would be useful to neuropsychiatric examiners in evaluating somatic and nervous complaints evoked during the screening examination.

As volunteer enlistments for the Navy are still accepted from those under 18 and over 37, the age breakdown of neuropsychiatric holdovers from the screening interview was examined to learn whether the drafted inductees furnished a larger ratio of such referrals than did the volunteers, and whether or not such larger ratio, if present, was most noticeable at ages 18 and 37.

Data were secured showing the age distribution of approximately 30,000 successive admissions to Great Lakes Naval Training Station during the period 14 July to 16 August 1943. Similar figures for the neuropsychiatric holdovers from the screening examination for the same period were also compiled. (The latter figures did not include the psychologic cases; that is, those held over for observation of illiteracy or mental defect.) Percentages

of holdovers for the age groups in question were then ascertained. The results are shown in table 1.

TABLE 1.—*Ratio of neuropsychiatric holdovers in different age groups*

	White recruits			Negro recruits		
	Ages			Ages		
	18 to 37	—18 & 37 +	18 & 37	18 to 37	—18 & 37 +	18 & 37
Number of cases	20,845	2,982	9,190	5,551	484	1,495
Number of NP holdovers	829	132	292	530	47	164
Percent NP holdovers . .	4.0	3.1	3.2	9.5	9.7	11.0

It is seen that the percentage of NP (neuropsychiatric) holdovers is about the same for those drafted as it is for the volunteers. (The legend —18 & 37+ means, of course, those under 18 plus those over 37.) For the Negro inductees the percentage of holdovers is even a trifle lower for the draftees. For the white recruits, the excess of six-tenths of one percent among the draftees is not statistically significant, even with the large number of cases involved. The percentage of holdovers among those at the borderlines of the drafted group (ages 18 and 37) for the white recruits is even lower than for the volunteers. There is some rise here among the Negro inductees, but again the difference is small and not statistically significant.

Among 29,862 successive inductees at Great Lakes Naval Training Station during July-August 1943, the ratio of neuropsychiatric holdovers from the screening examination did not increase, either among those drafted as compared with volunteers, or among those at the upper and lower extremes of the draft ages as compared with the entire group of draftees.

These findings do not support the supposition that drafted Naval inductees are tending to overstress or invent somatic ailments or "nervous" symptoms during their medical checkup on arrival at a Naval training station.

REFERENCES

1. GERSTLE, M., JR.; WAGNER, R. L.; and LODGE, T.: Inapt naval recruit. U. S. Nav. M. Bull. 41: 480-492, March 1943.
2. GRAMLICH, F. W., and STOUFFER, G. A. W.: Functions of psychologist in neuropsychiatric unit at Farragut Naval Training Station. J. Consult. Psychol. 7: 211-215, 1943.
3. LEWINSKI, R. J., and PENNINGTON, L. A.: Professional services and training requirements of the psychologist in Class H-V(S) of Navy. Psychol. Bull. 40: 519-527, 1943.
4. WITTON, C. L.; HARRIS, H. I.; HUNT, W. A.; SOLOMON, P. S.; and JACKSON, M. M.: Neuropsychiatric selection of recruits. Am. J. Psychiat. 99: 639-650, March 1943.

YAWS SURVEY ON NANUMEA ATOLL

IRA D. LEFEVRE, JR.
Lieutenant (MC) U.S.N.R.

KENNETH F. McDERMOTT
Lieutenant (MC) U.S.N.R.

and

ROBERT B. VENNER
Lieutenant (MC) U.S.N.

The investigation of yaws reported here was made among the natives of the Nanumea atoll in the Ellice Islands during the month of January 1944.

No attempt was made to treat the subjects of the British Crown as they are cared for by a native medical practitioner, a graduate of the medical school in the Fiji Islands, who is responsible for the health of the natives in the Ellice Island group. Children who have the lesions of yaws (Katane), are injected with neoarsphenamine in accordance with standard dosages for age and weight. A course of treatment consists of three injections at weekly intervals and in most cases the lesions are easily healed. However despite the disappearance of clinical signs, the Kahn remains positive. Reinfection is possible and signs of secondary yaws appear in certain numbers of children who have had their former lesions healed following injection.

In the three age groups, infants, children, and adults, the relative number of persons with positive Kahns increases through adolescence and is highest among the adult group. One would conclude, therefore, that though the clinical signs of yaws are controlled by one or two series of injections, it is doubtful if the disease is ever completely eradicated. Many of the lesions disappear without treatment.

As stated before no attempt was made to treat these natives nor was any attempt made to discover the efficiency of the treatment. It was intended only to discover the nature and appearance of the primary yaw for diagnostic purposes, the site and appearance of the secondary lesions and the various ages at which the Kahn test would be positive.

One hundred forty-nine persons were examined. A history was incorporated in the survey, as it had been proved in a previous filarial survey that the history related by the natives was very reliable and well substantiated by clinical and laboratory findings. Such was found to be the case in the present survey, as

46 percent of the 97 children examined gave a positive history of yaws, with or without treatment, and 46 percent of the 66 Kahns run successfully on this group of 97 were positive. The 149 natives were divided into 3 groups: Infants under 4 years of age, children and adolescents from 4 to 16 years of age inclusive, and adults over 16.

The primary yaw was found only in the infant group and in the younger half of the second group. Very possibly a diagnostic error modifies this statement. The secondary yaws were manifested by lesions of the soles of the feet and palms of the hands, although the younger children occasionally presented the granulating hyperkeratotic lesions of the perineum and gluteal fold. One infant had a secondary lesion on the prepuce. In the adult group there were few evidences of active lesions, although those with a positive history often presented irregular areas of depigmentation of the skin. Not many natives presented tertiary yaws, and of those who did, the pathologic changes were in the bones and joints.

Darkfield examinations were done and numerous positive results found. However, either because of poor technic, previous treatment or old subsiding lesions, no correlation could be made between the results of the darkfield and the clinical evidence substantiated by the Kahn. One lesion on the finger of a girl 11 years old, which had recurred following the disappearance of yaws on the feet after a series of injections 8 months previously, was teeming with spirochetes.

The following data were tabulated:

Babies (3 years old and under).

1. Clinical examination:
 - a. 24 babies examined.
 - b. 7 babies with histories of yaws.
 - c. 6 babies with clinical yaws, primary and secondary.
 - d. 18 babies without clinical yaws.
 - e. 1 baby had had treatment for yaws.
2. Results of Kahn examinations:
 - a. 5 Kahns (4 accurate).
 - b. 1 Kahn positive.
 - c. 3 Kahns negative.
 - d. 1 Kahn hemolyzed.

Age group from 4 to 16 years.

1. Clinical examination:
 - a. 97 children examined.
 - b. Histories:
 1. 45 children (46 percent) gave positive histories.
 2. 48 children (51 percent) gave negative histories.
 3. 4 children (3 percent) uncertain.

c. Clinical evidence:

1. 38 children (39 percent) presented clinical yaws.
2. 14 children (14 percent) inaccurate examinations.
3. 45 children (47 percent) no clinical yaws.
4. 25 percent had received treatment for yaws.

2. Results of Kahn examinations:

- a. 70 Kahns run on this group of 97 children (66 accurate):
 1. 30 Kahns (45 percent) of 66 accurate were positive.
 2. 36 Kahns (55 percent) of 66 accurate were negative.
 3. 3 Kahns hemolized.
 4. 1 error in technic of reading Kahn.

Adults over 16 years of age (workers on Nanumea).

1. Clinical examination:

- a. 28 men examined.
- b. 5 (17 percent) presented clinical evidence of yaws.
- c. 23 (83 percent) presented no clinical evidence of yaws.

2. Results of Kahn examinations:

- a. 28 Kahns run on 28 men.
- b. 20 (71 percent) Kahns positive.
- c. 8 (29 percent) Kahns negative.
- d. 0 errors in Kahn test.

CONCLUSIONS

1. Infants nearing 3 years of age are just entering the age group in which they were most likely to contact yaws.

2. Approximately 50 percent of the children under 16 years of age present positive evidence of yaws.

3. The adult age group, with or without clinical signs of yaws, is found to have the highest number of positive Kahn tests.

4. Fractional injections of 1 gm. of neoarsphenamine according to age and weight will in most cases cause the disappearance of the clinical signs. However under this routine (as shown by the Kahn test) the disease process is not eradicated.



FROSTBITE AND CHANGES IN SPINAL CORD

Both clinical observations and numerous experimental investigations have pointed to the integral role of the nervous system in the pathogenesis of frostbite. These studies have suggested that the histopathologic changes found in the peripheral nerves during frostbite may produce severe clinical symptoms and may predetermine the development, course, and outcome of the disease. Frostbite first manifests itself in sharp pains, reflex spasm, and other signs pointing to damage of the nervous system. The microscopic picture found in the nerve trunks of

twelve patients suffering from frostbite of varying degrees, who had died from some intercurrent disease, is that of a typical ischemic neuritis and the primary structural disturbances are signs of intensive fibroblastic hyperplasia and hypertrophy.

The topographic distribution of the pathologic process manifests itself in small axial islands of degenerative necrosis, which are scattered in both vertical and horizontal directions, at different levels, throughout the nerve trunk. These areas usually lie in the immediate proximity of the blood vessels, suggesting that the scattered areas of degeneration and necrosis are due to vascular influences. It may be pointed out that the pathologic and histologic disturbances as well as some of the clinical signs observed in spontaneous gangrene due to other causes are, in many respects, similar to those observed in frostbite of the extremities.

Detailed microscopic study of the anterior horns of the spinal cord and of the intervertebral ganglia was done. Chromatolysis of varying degree was the most typical finding characterizing the condition of the nerve cells of the anterior horns of the spinal cord and of the intervertebral ganglia. The histopathologic changes within the nerve cells of the anterior horns and of the intervertebral ganglia ranged from slight chromatophylic granular degeneration of the central area to complete disintegration of the cellular structure and occasionally hyperchromatosis and pycnosis.

The changes were found only at the level of the spinal cord sections related to the innervation of the injured extremities. There were no retrograde changes found in the control sections of the spinal cord and the intervertebral ganglia lying above and below this level. The higher the level at which injury by cold occurred in an extremity, the more intense was the tissue damage in the spinal cord, especially if frostbite persisted for some length of time.

These changes must be considered in their relation to the effect of cold on the peripheral portion of the axone. The length of exposure, the intensity of the cold, and the site of injury determine the extent of the damage. Frostbite may, therefore, be followed by retrograde degeneration, preceded by irritation of and damage to the cells.

Frostbite, because of its effect on peripheral nerves and spinal centers, produces a heightened susceptibility and frequent recurrence of infection. These observations further corroborate the relationship existing between the effect of frostbite, some forms of obliterative endarteritis, and some types of spontaneous gangrene. The structural disturbances occurring in the distal portions of the spinal cord as a result of frostbite are, however, still controversial.—PANCHENKO, D. I.: Retrograde changes in spinal cord in frostbite of extremities. *Am. Rev. Soviet Med.* 1: 440-443, June 1944. Abstracted from *Nevropatolgia i psikhiaatria* 12: 75-79, 1943.

CLINICAL NOTES

SPONTANEOUS RUPTURE OF THE MALARIAL SPLEEN

JAMES M. MARSHALL
Lieutenant Commander (MC) U.S.N.R.

Rupture of the spleen is always a serious and dramatic surgical problem. When it immediately follows direct trauma the diagnosis is relatively easy. In the so-called "delayed rupture" in which there is a latent, symptom-free period following injury, accurate diagnosis is less often promptly made. Spontaneous rupture of the spleen in the complete absence of a history of trauma of any kind is a diagnostic assignment which is not only difficult but extremely urgent. The seriousness of the associated internal hemorrhage does not permit procrastination.

Galen many centuries ago spoke of the spleen as an organ "full of mystery." It is the most friable of all the abdominal organs. Its relatively superficial location, relatively fixed anatomic anchorage, and its known ability to engorge itself with blood are all factors which increase its susceptibility to mechanical rupture. There is considerable evidence that the apparently normal spleen can, under certain pathologic conditions, rupture spontaneously. Zuckerman and Jacobi (1) were able to verify 20 such cases from the literature. It is questionable, however, whether a completely normal spleen ever ruptures spontaneously without trauma. That this catastrophe does occasionally happen to the patient with an enlarged, diseased spleen has been amply proved by authentic reports in the literature.

Connors (2), Fieber (3), Watson and Ferderber (4), and others have reported their own and collected cases. De Saram and Townsend (5) recently reported a fatal case of spontaneous rupture of an enlarged malarial spleen diagnosed at autopsy. Bueermann (6) reported a similar case in a patient who had chills and fever resembling a single attack of malaria he had had many years previously in India. Although plasmodia were not demonstrated in Bueermann's case the evidence seemed to indicate definite malarial splenitis. In the reported cases of spontaneous rupture of the spleen, malaria has been by far the most common etiologic factor, but cases are on record associated with certain other "tropical" diseases (with splenomegaly) as well as with

various acute infectious diseases such as typhoid fever, and with such noninfectious diseases as cirrhosis of the liver and leukemia.

According to Coggeshall (7) and others malaria is the most prevalent disease in the world today and probably ranks foremost as a cause of morbidity. With the wide dispersal of our armed forces throughout the world, we, in the United States, must expect to see an increasing number of patients who have or have had malaria and therefore probably have enlarged spleens. In the following case of malarial splenic enlargement, rupture of the spleen occurred spontaneously without apparent trauma of any sort.

Case report.—A Marine corporal, aged 24, was admitted to the hospital in a stuporous condition. He could be only partially aroused and the immediate history was obtained from his brother. The patient had visited his brother's home on week-end liberty arriving there before noon on the day of admission to the hospital. He had told his brother that 3 days previously he had had an attack of malaria with chills and fever but had recovered in 24 hours by taking quinine and atabrin. This had been his 14th attack of malaria in 12 months, most of which time had been spent in the Southwest Pacific theater of operations. Shortly after noon he began to complain of a dull, generalized, aching pain in the abdomen and stayed in the house, comparatively quiet. About 6 hours later he complained of severe abdominal pain and vomited once. One hour later he was seen by a civilian physician who found generalized abdominal tenderness and rigidity. A hypodermic injection of 1/100 grain hyoscine, ¼ grain morphine, and 1/60 grain cactoid was given and repeated 1 hour later because of persistence of the severe pain. The patient was then brought to this hospital by ambulance, a distance of 25 miles.

On admission he was very drowsy and mentally dull and confused. He was obviously acutely ill, in much pain, and unable to answer simple questions. The skin showed the yellowish tinge typical of those who have been taking atabrin. The blood pressure was 125/75 and the pulse rate 120 per minute. The temperature was 97.8° F. and the respirations were 20 per minute. There were no external marks of trauma. Examination of the heart and lungs elicited no abnormal findings. The abdomen was neither distended nor retracted, but exhibited a boardlike rigidity with no focal point of tenderness. There were no palpable masses and neither the liver nor the spleen could be felt. It was questionable whether the flanks were abnormally dull to percussion. Rectal examination disclosed no abnormalities.

The catheterized urine was a dark amber color, had a specific gravity of 1.030, was acid in reaction, with no albumin or sugar, and showed an occasional leukocyte. Examination of a blood specimen showed a hemoglobin content of 9.5 gm., 3,480,000 erythrocytes and 5,050 leukocytes. An emergency roentgenogram taken in the vertical position revealed no free gas under the diaphragm. The impression was that the patient had a perforated abdominal viscus, probably acute perforation of a peptic ulcer, and immediate laparotomy was advised.

Approximately 10 hours after onset of the initial symptoms, with the patient under nitrous oxide-oxygen and ether anesthesia, the abdomen was opened through a 10-cm. upper right rectus incision. Upon opening the peritoneum,

free blood was encountered. Quick manual examination showed a greatly enlarged spleen to be the source of the bleeding. A 20-cm. left oblique sub-costal incision was made and the splenic vessels were compressed digitally. At least 1,000 cc. of blood was then evacuated from the peritoneal cavity, together with many large blood clots around the spleen and under the left side of the diaphragm. The large purple spleen, which measured 25 by 15 by 8 cm., was ruptured transversely through the middle, the two halves being held together only by the intact capsule on the pedicle side. A triangular fragment of spleen 6 by 8 by 10 cm. had become completely detached from the anterior-superior border of the fracture line and was found floating free in the anterior peritoneal cavity. The splenic capsule was ruptured transversely across the convex surface.

The spleen was removed and the vessels of the pedicle were each doubly ligated. The peritoneal cavity was then thoroughly emptied of its remaining blood clots and washed out with warm saline solution. Five grams of crystalline sulfanilamide were instilled into the splenic fossa of the peritoneal cavity and the wounds closed without drainage. The operation lasted 50 minutes and during that time 1,000 cc. of pooled blood plasma was given intravenously. Although the patient left the operating room in fairly good condition, with a blood pressure of 120/70 and a pulse rate of 120, 500 cc. of citrated whole blood was administered on his return to the ward.

The spleen weighed 716 gm. The microscopic findings were consistent with those of a malarial hypertrophic spleen with infarction and rupture.

The patient's convalescence from the operation was uneventful except for one incident of a chill and a fever of 103° F. on the third postoperative day. At this time the blood smear showed the presence of *Plasmodium vivax*. This was promptly controlled with quinine and atabrin. Blood count on the twelfth postoperative day showed 4,500,000 erythrocytes and the hemoglobin content was 13 gm. The patient left the hospital in good condition on the twenty-eighth postoperative day.

COMMENT

Following operation the patient was very carefully questioned. He could remember no injury of any consequence during his lifetime and no direct trauma, even of a minor nature, to the splenic area.

He had been attached to a Marine division in California for the preceding 3 months but had not during that time engaged in strenuous maneuvers and had not participated in arduous athletic diversions. He had been operating a caterpillar tractor and, although he recalled no collisions or accidents of any kind, there had been moderate jarring and jolting while he was riding the tractor. However, prior to the day of rupture he had no distress of any kind in the splenic area. He had not been on his tractor for 4 days prior to the splenic rupture, because he had had an attack of malaria. The most strenuous traumatic influence to which he had been subjected during the 4 days prior to admission was riding in a passenger automobile on a paved highway for a distance of 100 miles the day before his illness. For 6 hours prior

to the onset of his severe pain (probable time of rupture) he had been quietly sitting or lying down at home. He had defecated approximately one hour before the onset of the pain but stated that it was not associated with straining and caused him no distress. It therefore seems justifiable to assume that this patient suffered a nontraumatic, spontaneous "explosion rupture" of an enlarged malarial spleen as the result of an infarct.

The correct diagnosis was not made preoperatively. The excessive sedation given to the patient elsewhere prior to his admission was a handicap in that it not only prevented us from obtaining a satisfactory history but it also masked the symptoms and findings. Immediate laparotomy was advised because it was thought that the patient had an acute abdominal condition. A provisional diagnosis of an acute perforation of a peptic ulcer was made strictly on the basis of probability. We should have more strongly suspected internal bleeding, even though the blood pressure was 125/75. In this case the decision to open the abdomen immediately was the important one. I recently performed a splenectomy 47 hours after an accident, after carefully observing the patient for 16 hours in the hospital. During that period of observation the blood pressure never fell below 120/70 and the highest pulse rate was 88. The spleen was found to be completely fractured through the middle, the lower half of the spleen being detached and floating free in the peritoneal cavity where there was also at least 1,000 cc. of blood. The diagnosis of intraperitoneal bleeding is not always simple.

A point worthy of emphasis is that in patients who have, or have had, malaria and in whom an acute abdominal emergency develops, spontaneous rupture of the spleen must be considered as one of the possibilities. The majority of such cases in the past have terminated fatally chiefly because the true condition was not suspected in time and surgical intervention was not instituted. Immediate splenectomy is the only treatment; mortality without operation is probably 100 percent. As in traumatic rupture, hemorrhage is the most important factor.

In addition to immediate operation, whole blood or plasma or properly filtered autotransfusion blood, should be administered promptly and in adequate amounts to compensate for the hemorrhagic loss. The mortality will depend almost entirely upon the promptness with which these measures are carried out.

SUMMARY

Malaria is probably the most common disease in the world today. Many of the members of our armed forces are returning

with or have had malaria. Malaria causes an enlargement of the spleen. The malarial spleen is not only more easily ruptured with trauma but can spontaneously "explode" without trauma. Early diagnosis and immediate splenectomy is the only effective treatment. To suspect the condition promptly is to accomplish the major portion of the cure.

REFERENCES

1. ZUCKERMAN, I. C., and JACOBI, M.: Spontaneous rupture of normal spleen. *Arch. Surg.* 34: 917-928, May 1937.
2. CONNORS, J. F.: Ruptured spleens. *Ann. Surg.* 74: 1-7, July 1921.
3. FIEBER, E. L.: Influenza with rupture of spleen. *Wien. klin. Wchnschr.* 34: 581-583, December 1, 1921.
4. WATSON, J. R., and FERDERBER, M.: Spontaneous rupture of normal spleen. *J.A.M.A.* 120: 690-691, October 31, 1942.
5. DE SARAM, G. S. W., and TOWNSEND, R. F.: Spontaneous rupture of spleen in malignant tertian malaria. *Lancet* 1: 584-585, May 8, 1943.
6. BUERMANN, W. H.: Latent period and delayed hemorrhage following traumatic rupture of spleen. *U. S. Nav. M. Bull.* 41: 73-93, January 1943.
7. COGGESHALL, L. T.: Malaria as world menace. *J.A.M.A.* 122: 8-11, May 1, 1943.



GANGRENE OF THE FINGER FOLLOWING NERVE BLOCK

The injected solution may interfere with the digital circulation and produce gangrene if too much solution is used, or if epinephrine is present in the solution or if tourniquets are used. If the damage to the circulation is not sufficient in itself to produce the gangrene, subsequent soaking of the finger in hot or even warm water may hasten devitalization of the tissue.

Digital nerve block should be replaced whenever possible by a general anesthesia using pentothal or gas-oxygen or ether. If it becomes necessary to use a local anesthesia, great care should be taken in performing the nerve block. No tourniquet nor solution containing adrenalin should be used. Only a small quantity of solution should be used, i.e., about 1 to 1½ cc. for the entire block. Soaks should be contraindicated for at least twenty-four hours.—O'NEIL, E. E., and BYRNE, J. J.: Gangrene of finger following digital nerve block; report of eight cases with discussion of gangrene pathogenesis. *Am. J. Surg.* 64: 80-87, April 1944.

PRIMARY AXILLARY VEIN THROMBOSIS

REPORT OF A CASE

NORMAN H. BRUCE

Lieutenant (MC) U.S.N.R.

Primary axillary vein thrombosis occurs chiefly in young males who are performing strenuous work. Since a comprehensive survey of the subject by Matas (1) in 1934 numerous reports of cases have appeared in the literature. Several cases have recently been reported (2) (3) (4) which attest to its not uncommon occurrence among Naval personnel. The usual chronicity of the process makes this condition a considerable cause of disability.

The case to be reported here is presented in an effort to stress the important role of venospasm in the syndrome and to suggest that therapeutic attack on this phase of the problem, rather than on the purely mechanical thrombus, may be expected to offer better results.

One explanation for the actual formation of the thrombus is given by Lowenstein (5) who has demonstrated by autopsy that with the arm extended and abducted, the coracoid ligament and subclavius muscle indent the vein for as much as 3 millimeters. It is held that injury to the intima occurs with subsequent thrombus formation. Cottalorda (quoted by Matas), believed that venospasm occurring from sympathetic irritation which the trauma set up was responsible for the thrombosis. DeBaakey and Ochsner (6) (7) have pointed out that venospasm is present in cases of thrombophlebitis, and that its effect on the sympathetic nerves is an important factor in production of the clinical manifestations of the condition.

The clinical picture is that of rapid swelling of an arm, ordinarily occurring on the right side in right-handed individuals and vice versa. Pain is variable in amount but characteristically is not severe and often is absent. Inspection usually reveals diffuse, brawny edema, varying degrees of mottling and cyanosis, and lowered skin temperature of the affected arm. There is ordinarily no febrile reaction, and studies of blood clotting and viscosity show them to be normal. The history of specific trauma may not always be definite, but arduous use of the arm invariably precedes development of the swelling.

The usual treatment recommended is an expectant and supportive one. Rest, elevation, immobilization, and diathermy are all recommended. Surgical treatment of the thrombosed segment,

either for removal of the thrombus, ligation and division of the vein, or resection of the thrombosed segment, has been advised only after a considerable period (3 to 9 months) of unsuccessful conservative expectant treatment. Willcutts and Shelburne (4) recently reported two cases, one of which was relieved promptly by injection of the sympathetic nerves. The other case, in which injection is not believed to be indicated, was treated conservatively and as the patient was unimproved at the end of 9 months, he was discharged from the service.

It would appear to be amply demonstrated that the mechanical obstruction in itself is not responsible for the clinical picture of this thrombosis. For example, in the course of radical mastectomy, a segment of the axillary vein is frequently removed without the development of edema. Again, in the lower extremity, the femoral vein may similarly be ligated, as is so often done in the treatment of thrombophlebitis with pulmonary embolism, without the appearance of signs of venous obstruction. Also writers have frequently commented on the rapid disappearance of edema from the arm following ligation and section of the axillary vein in cases of primary thrombosis.

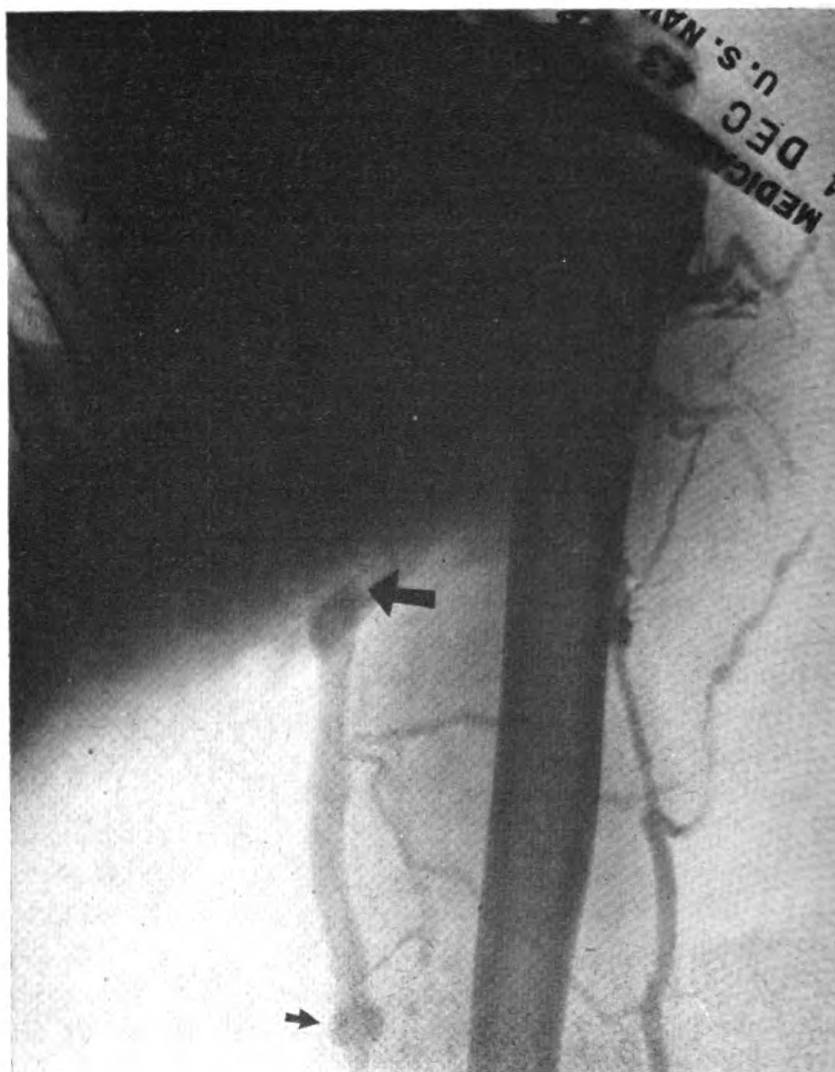
This strongly suggests that the success of the therapeutic response lies in interruption of the sympathetic irritation in these cases. Injection of the sympathetic ganglia with novocain is the simplest method of accomplishing this. The following case is an example of such treatment with very favorable results.

Case report.—A 23-year-old aviation machinist's mate, third class, entered the dispensary with the complaint of swelling of the left arm. Careful questioning failed to elicit any history of specific acute injury, but the patient stated that his work was vigorous and involved considerable heavy lifting and continued raising of his arms over his head. He stated that he was left-handed. The swelling had come on suddenly over a period of slightly more than 1 hour and was unattended by any pain except for a slight "sore" feeling in the region of the angle of the left scapula.

Examination revealed a healthy appearing young man with an extremely well developed musculature. The only abnormality noted was in the left upper arm, where there was diffuse, brawny edema involving the left arm from the shoulder to the fingertips. The skin was mottled, faintly cyanotic and definitely cool as compared with the opposite arm. There were several small, shotty, nontender axillary lymph nodes apparently of no significance.

The axillary vein was not palpable but there was very slight tenderness over its course. Numerous tortuous, dilated collateral veins were seen running over the left upper arm, shoulder and upper anterior thorax. Measurements of the left arm revealed an increase in circumference of $1\frac{1}{4}$ inches of the mid upper arm, $1\frac{1}{2}$ inches of the mid forearm and $1\frac{1}{2}$ inches at the wrist. The patient was able to make only a loose fist because of the edema of the hand. Blood pressure was identical in both arms.

Laboratory studies including complete blood counts, bleeding and clotting times, and repeated urinalyses all yielded negative results. An x-ray of the

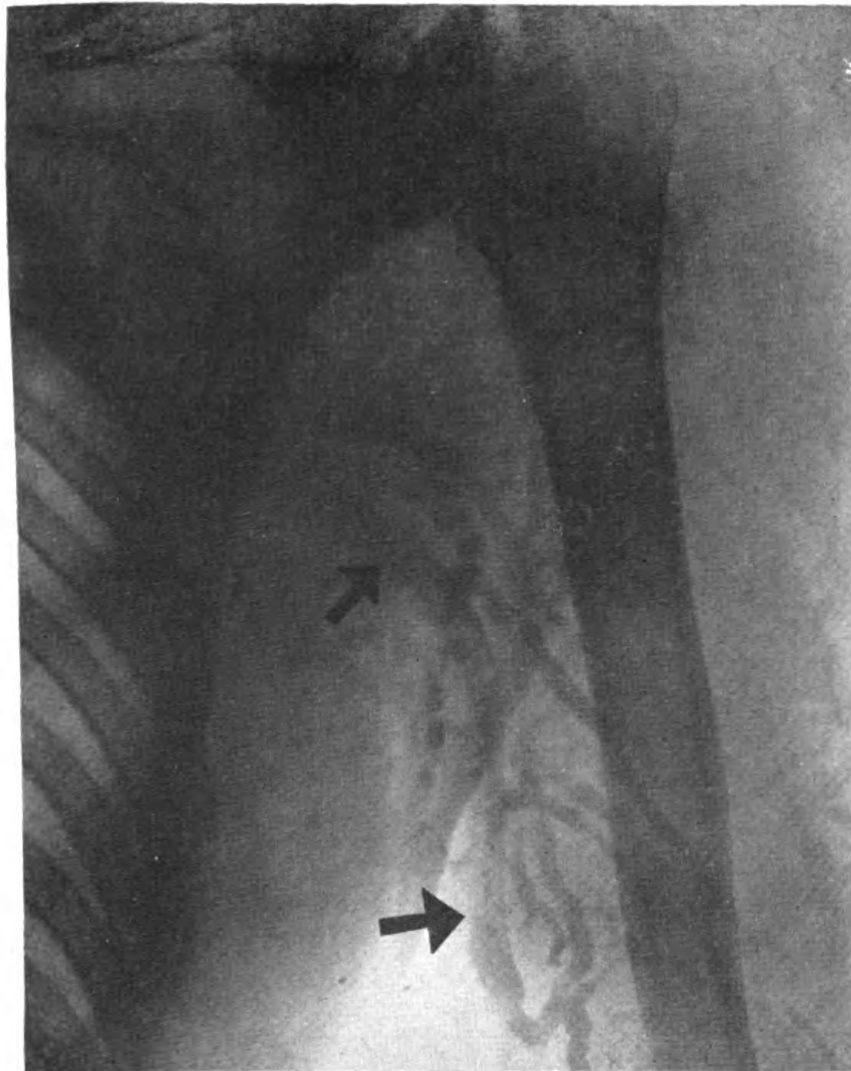


1. Venogram made shortly before paravertebral injection was done; this film was taken 15 seconds after the injection of 20 cc. of Neo-Iopax. Large arrow indicates site of complete venous block. Remarkable development of collateral circulation is shown. Smaller arrow indicates valve in vein dilated because of obstruction. The cusps are well outlined.

chest likewise disclosed no abnormalities.

Treatment consisting of the application of an elastic bandage from the fingers to the shoulder, with overhead suspension of the arm by balanced traction, was instituted immediately. This was continued without interruption for 1 week. At this time measurements of the arm were identical with those at admission. The faint cyanosis and lowered skin temperature persisted without improvement.

Seven days later a venogram of the affected arm was made (fig. 1); it revealed complete block of the axillary vein. On the afternoon of the same day, paravertebral injection was carried out. A total of 75 cc. of 1-percent novocain was used, and the stellate ganglion and first to fourth dorsal ganglia were injected. One half hour after injection, the skin temperature was definitely raised and appeared to be the same as that of the opposite arm.



2. Venogram made 17 days later. Arrows indicate limits of thrombosed segment. There is partially reestablished venous flow, with narrowed lumen and irregularity of wall of vein. Light areas within vein indicate shadows of thrombi. At this time the patient was clinically well.

The following morning the edema had entirely disappeared from the hand and wrist and the patient could make a normal tight fist. The increase in the skin temperature was striking and the color was normal. He was allowed up and about following injection and no further treatment was given. One week later measurements of the circumference over the left arm showed only slight increase in size compared to the right arm. The collateral veins were much less prominent.

A check venogram made 9 days later is shown in figure 2. At this time, measurements of the two arms were identical and the patient had no complaints.

Twenty-seven days after admission the patient was discharged to duty with instructions to avoid only the most strenuous tasks and use the arm liberally. He reappeared for checkup at regular intervals complaining only of very slight soreness in the region of the angle of the left scapula; this



3. Venogram made about 10 weeks after paravertebral injection. At this time the patient had been on active duty for almost 2 months. Narrowing of segment is apparent, but appearance closely approximates that of a normal venogram.

soreness was not related to use of the arm. There had been no swelling of the arm or hand after use. A final venogram was made 18 days later (fig. 3), and the patient was discharged to full duty as cured.

REFERENCES

1. MATAS, R.: On so-called primary thrombosis of axillary vein caused by strain; report of case with comments on diagnosis, pathogeny, and treatment of this lesion in its medico-legal relations. *Am. J. Surg.* 24: 642-666, June 1934.
2. KEENER, H. A.; CANTY, T. J.; and PREVOST, J. V.: Thrombosis of axillary vein caused by strain or effort; report of case occurring in deep-sea

- diver, and brief résumé of subject. U. S. Nav. M. Bull. 40: 687-692, July 1942.
3. STABINS, S. J.: Primary thrombosis of axillary vein due to strain. U. S. Nav. M. Bull. 41: 1106-1114, July 1943.
 4. WILLCUTTS, M. D., and SHELburnE, S. A.: Thrombosis of axillary vein; report of 2 cases with clinical investigation. U. S. Nav. M. Bull. 41: 1730-1733, November 1943.
 5. LOWENSTEIN, P. S.: Thrombosis of axillary vein. J.A.M.A. 82: 854-857, March 15, 1924.
 6. DEBAKEY, M.; OCHSNER, A.; and SMITH, M. C.: Primary thrombosis of axillary vein. New Orleans M. & S. J. 95: 62-70, August 1942.
 7. OCHSNER, A., and DEBAKEY, M.: Thrombophlebitis; role of venospasm in production of clinical manifestations. J.A.M.A. 114: 117-124, January 13, 1940.



MOSS AS SURGICAL DRESSING

Under emergency conditions it is well to remember that a well-dried or cured moss is easily sterilizable under the same conditions of sterilization required for cotton or gauze dressings.

The absorptive powers of moss are dependent on the character of the leaves which are in the form of hollow cells. When growing, the leaf cells are more or less completely filled with water which, however, can easily be removed by compression followed by drying. The dried moss is brittle and easily broken. However, the dried moss will retain its absorptive power better than a substance like cotton, as the liquid taken up is stored chiefly inside the leaves and cells, instead of merely being held between adjoining strands.

Moss that is to be used for surgical dressings should be skillfully collected. Only the best grade of moss should be selected and only stems covered by leaves ought to be included for use.

Cotton dressings will take up from four to six times their dry weight of water. The Florida moss will take up from six to ten times its dry weight of water. The amount of water which moss will hold is considerably reduced by handling, even though the handling is carefully done, because every time moss is handled after it is dried, it breaks up. The breaking of the leaves reduces their absorptive ability. Florida moss when dry is exceedingly light and brittle and owing to the smallness of the pieces into which the leaves break up these small bits tend to penetrate the gauze covering. The rate of drying of the moss has a pronounced effect on its brittleness. The best results are obtained if the moss is dried slowly at ordinary temperatures, as for instance on a normal summer day in the open air. Moss dried under these conditions remains soft and elastic.—MAYO, C. W., and WAKEFIELD, E. G.: Use of moss as surgical dressings. Proc. Staff Meet., Mayo Clin. 19: 65-66, February 9, 1944.

DERMATITIS FROM BLUE UNIFORMS

CEDRIC C. CARPENTER

Lieutenant Commander (MC) U.S.N.R.

and

JOHN W. BANZER, JR.

Lieutenant, junior grade (MC) U.S.N.R.

Dermatitis produced by dyed or undyed woolen clothes is well known in civil life and is not of serious moment because of the wide selection in dyes and materials available to the individual. However the limited wardrobe of the Naval service makes such an idiosyncrasy a matter of importance, affecting the ultimate duty status of those persons who show sensitivity.

There is only one previous mention of skin irritation due to the blue dye used in service blue uniforms (1). These cases occurred in the enlisted personnel of the Coast Guard and necessitated the discharge of one SPAR. We have seen several patients with skin irritations which we believed to have been due to the effect of the wool fabric, but the cases to be reported are those of men who could only tolerate their blue uniforms for a short period because of cutaneous hypersensitivity.

The eruption produced by the blue uniform is found to be limited to those areas not covered by the undergarments and is most intense on the upper inner aspect of the thighs, the inner surface of the arms, the antecubital fossae and the wrists. Typically there is a sheetlike, deeply erythematous epidermitis, with a fine branny scale. No active vesiculation is noted, but the pruritus is severe. Two of our patients had a mild associated conjunctivitis.

The following materials were used in patch-testing these individuals:

1. The undyed wool threads from the Navy Medical Department blankets.

2. One-quarter inch squares of the blue cloth used in making sailors' uniforms, consisting of the following types of dye and material:

Julliard 16 ounce, Melton, chrome-dyed uniform cloth.

Flannel 11 ounce, indigo- and chrome-dyed uniform cloth.

Standard 16 ounce, Melton, alzerine- and indigo-dyed uniform cloth.

Individual's own uniform of undetermined material, dye and finish.

3. The waxy residue of the uniform "finish" removed by ether extraction for 6 hours in a covered jar and concentrated by evaporation (4).

4. The dry, powdered residue of dye obtained by evaporating the water in which a portion of blue uniform had been boiled. (Cold water soaking without the use of soap did not remove the dye (2).) This powdered concentrate was placed on a quarter-inch square of damp, white blotting paper before being applied to the skin. All patch tests were made with overlying cellophane to prevent confusion with the adjacent adhesive plaster reactions. They were placed near the sites of inflammation and in the same lymphatic drainage areas. Readings were made at 48 and 72 hours and graded from one- to four-plus, depending on the degree of erythema present. Positive reactions were similar in pattern to the eruption itself and in no instance was there any vesiculation.

CASE REPORTS

Case 1.—A torpedoman's mate, second class, 25 years of age, who had had 4 years of service, was admitted to this hospital with a history of dermatitis of gradual onset, involving the forearms, thighs, face and occasionally the conjunctivae. This eruption appeared only when he came ashore in a northern port, where he maintained an apartment. For this reason he attributed it to the dust in his home. It disappeared a week after going to sea, at which time he wore only dungarees, and had not recurred when he went ashore in his white uniform in South America and Africa.

Results of patch tests: Chrome-dyed uniform cloth.....	++++
Indigo- and chrome-dyed uniform cloth.....	++
Alzerine- and indigo-dyed uniform cloth.....	++
Own blue uniform cloth.....	++++
Wool threads	++
Finish extract	+
Dye concentrate	+++

When he was restrained from liberty for a week, and wore only dungarees, the eruption disappeared, but he showed definite exacerbations when wearing his uniform for even a short time on liberty.

Case 2.—A seaman, second class, 21 years old, had been on active duty for 9 months prior to his admission to the sick list. He had had several recurring attacks of dermatitis, believed to be due to handling ammunition, in the early spring of 1943. However, he had no recurrence during the succeeding summer, in spite of continued contact with "powder." In the fall the eruption recurred. It was particularly marked on the forearms, the antecubital fossae and on the flexor surfaces of the wrists, and there was a mild, accompanying conjunctivitis. His skin difficulties entirely cleared up when he was forced to wear white uniforms for a week, but recurred each time he wore his blues when going on liberty.

Results of patch tests: Chrome-dyed uniform cloth.....	++
Chrome- and indigo-dyed uniform cloth.	+
Alzerine- and indigo-dyed uniform cloth	++
Own blue uniform cloth.....	++++
Wool threads	++
Finish extract	+
Dye concentrate	++++

Case 3.—A pharmacist's mate, second class, 32 years of age, had had no previous difficulties with his uniform while serving with the Fleet Marines. However, 5 years ago, in civil life, he had noted an eruption after wearing a soft woolen suit and for that reason had changed to hard-finish materials. He had experienced only minor difficulty from the blue uniform until November 1943, when he was forced to wear this uniform for 3 days while crossing the continent on a train. He was seen shortly after his arrival and presented the typical eruption, in a severe degree, on the upper and lower extremities, but not on any areas covered by his undergarments.

Results of patch tests: Chrome-dyed uniform cloth.....	+++
Indigo- and chrome-dyed uniform cloth.	+
Alzerine- and indigo-dyed uniform cloth	++++
Own blue uniform cloth.....	++++
Wool threads	++++
Finish extract	—
Dye concentrate	+++

His eruption was greatly improved when he was wearing long cotton underwear and he continued on active duty with this protection. All eruptions subsided when he wore whites or dungarees for a week.

COMMENT

Care should be exercised in the diagnosis of dermatitis from blue uniforms, as this condition may be confused with both pruritus and the mechanical irritation produced in tender skins by rough woolen garments. When the patch test results are negative, these latter factors should always be considered first. Also too much reliance should not be placed on the positive patch test, as Hutter (3) has found that some of these uniform-sensitive patients react to such unrelated substances as potassium dichromate. Therefore, further testing is necessary and should include at least one week's trial, under controlled conditions, of wearing white uniforms or dungarees, to see if the eruption will disappear. Following this test, patients should be forced to wear their blues, under the same conditions, to observe the degree of aggravation.

Schwartz (4) has found that no immunity can be obtained by continued use of the dyed clothing. He recommends that patients avoid the fabrics processed with chemicals to which they are sensitive. Downing (5) knows of no method of desensitizing these individuals and recommends their discharge. We have found the

wearing of long cotton underwear, as recommended by Hutter, to be of great help, but in addition drastic reduction in the number of soap and water showers taken during a week is advocated and the daily use of a bland ointment which does not contain lanolin is recommended. It would seem best to transfer these individuals to duty in a warm climate where there will be no need to wear the blue uniform.

REFERENCES

1. DOWNING, J. G.: Trauma of skin due to wartime activities. *New England J. Med.* 227: 539-544, October 8, 1942.
2. SHELTON, J. M., and BUSH, F. W.: Contact dermatitis from black cotton socks. *U. S. Nav. M. Bull.* 41: 1408-1410, September 1943.
3. HUTTER, A. M.: Personal communication.
4. SCHWARTZ, L.: Personal communication.
5. DOWNING, J. G.: Personal communication.



INGUINAL PAIN

Inguinal discomfort and a potential hernia developing late in life should be recognized as a possible early manifestation of prostatism.

A prostate which rectally may feel normal in size and consistency may be the cause of definite urinary obstruction by intra-urethral or intravesical protrusion of the gland. In these cases reliance must be placed on a carefully taken history.—GOODHOPE, C. D.: Inguinal pain: Early manifestation of bladder neck obstruction. *S. Clin. North America* 24: 715-717, June 1944.



NOVOCAINE FOR MORPHINE

Novocaine can be given intravenously with safety but individual sensitivity must be guarded against. It has the advantage over morphine in that it allows conscious patients who can assist themselves in precautions against postoperative pulmonary and vascular complications. The factor of vomiting and malaise due to morphine therapy is eliminated.

The longstanding concern over accidental introduction of local anaesthetic into veins during tissue infiltration is apparently unfounded.—MCLACHLIN, J. A.: Intravenous use of novocaine as substitute for morphia in postoperative care; preliminary report: *Roy. Canad. Navy M. J.* 7: June 1, 1944.

SYSTEMIC BLASTOMYCOSIS

WITH A NEW FORM OF THERAPY

JACK FISHMAN

Lieutenant (MC) U.S.N.R.

Since Gilchrist first described blastomycosis in 1894, approximately 380 cases have been reported. A review of the literature indicates that only 73 of these were definitely of the systemic variety, with a mortality rate of 83 percent. The remaining cases were of a cutaneous type. Potassium iodide, used by Gilchrist, has been the usual therapeutic agent, but its inadequacy is apparent by the high mortality rate. Penicillin also proved to be ineffective in one recent case.

The case presented here is of interest because it is a proved addition to the relatively few previously reported patients affected with the systemic form of blastomycosis. It demonstrates again the inadequacy of potassium iodide therapy while suggesting the efficacy of a new form of treatment. In addition, it may serve to emphasize the increasing importance of fungus diseases.

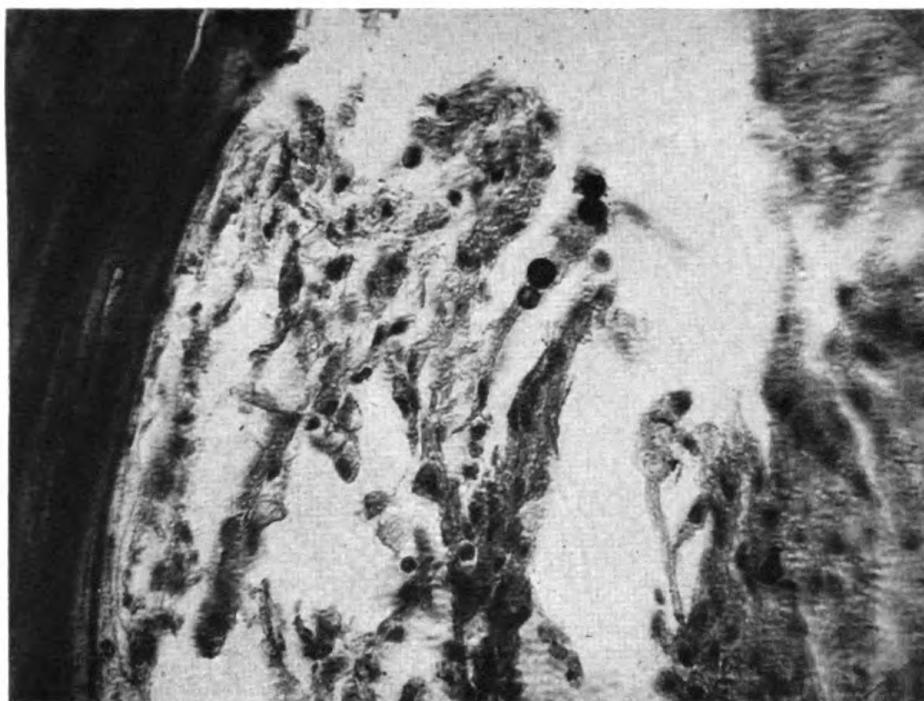
Case report.—The patient was a young woman, 19 years old, whose past history was pertinent only in that she had had a severe cold in May 1940, with cough, expectoration, and slight hemoptysis lasting for 2 months. She suffered mild trauma to the left foot from a falling object on 3 September 1940 and noted slight redness, swelling, and tenderness on the dorsum of the foot 5 days later. She was admitted to a civilian hospital on 10 September 1940 with an aggravation of these complaints. Her temperature was 104.4° F. X-ray examination of the foot at this time revealed no abnormalities. Two weeks later, however, x-ray examination revealed an osteomyelitis of the internal cuneiform bone of the left foot for which an Orr operation was performed. Pus and necrotic bone were obtained.

Three days following this operation, the patient coughed and complained of slight pain, and an x-ray film of the chest was taken which revealed dense irregular shadows at the hili extending to the periphery as small focal areas of infiltration, simulating miliary tuberculosis.

On 1 October 1940 a papule appeared on the patient's right elbow. This enlarged to the size of a dime in one month. Adjacentlly, a slightly larger skin lesion developed. Both lesions became crusted with wartlike processes, bled easily, and had a definite raised border, honey-combed with minute abscesses containing thick, glairy, mucoid pus.

On 15 November 1940 small nodules, apparently lymph nodes, were felt subcutaneously above the right elbow anteriorly and posteriorly. The lymph nodes in the left popliteal region also became palpable.

Laboratory findings.—Results of the urinalysis, blood culture and Wassermann were negative. The blood count indicated a polymorphonuclear leuko-



1. Microscopic section of necrotic bone of left foot showing darkly stained blastomycotic cells.

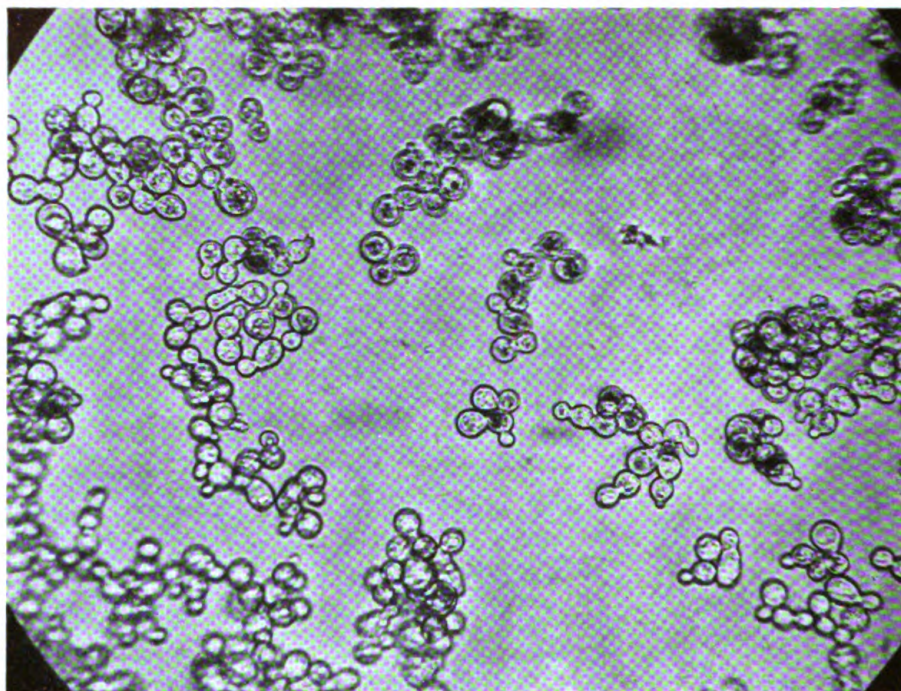
cytosis with a slight eosinophilia. The sputum and fasting specimens of gastric juice were negative for blastomyces and acid-fast organisms.

A microscopic section of bone revealed evidence of an acute osteomyelitis containing cells resembling blastomyces. Smears of pus obtained from the foot were prepared with 10-percent sodium hydroxide and immediate examination demonstrated only leukocytes, but after 3 hours these deteriorated and cells suggestive of blastomyces were seen. The latter, about the same size as leukocytes, had a double wall and contained granules.

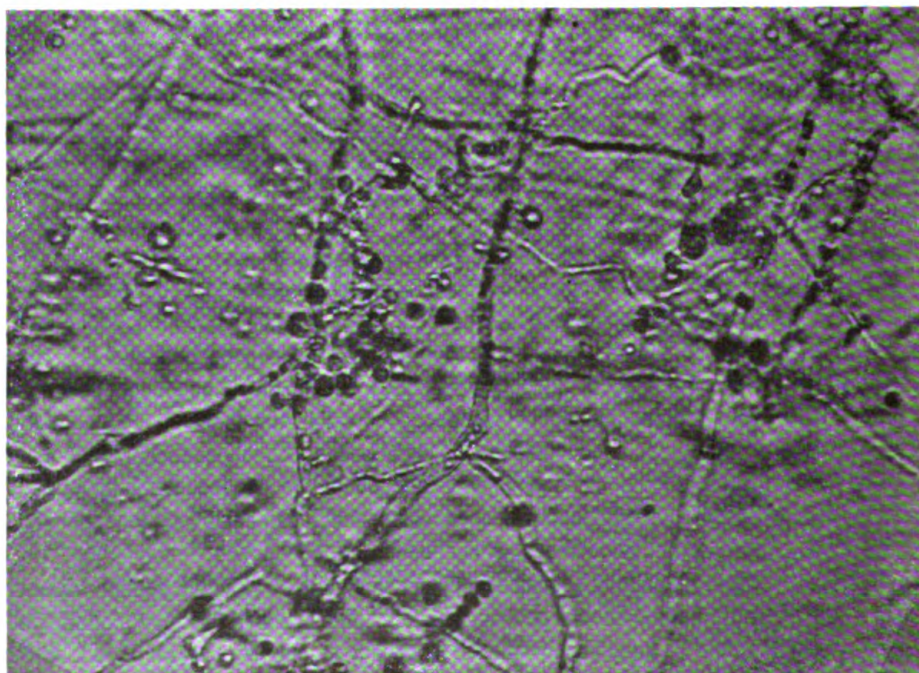
A portion of the exudate was cultured, inoculated into animals, and re-cultured. The resultant organism evidently was not a common yeast, for it did not ferment sugars with carbon dioxide production, but formed hyphae while failing to produce asci. The capability of producing hyphae also excluded its identification as *cryptococcus*, a pathogenic yeast. The small size of the organism and the failure of the spherules to break up into interior cells militated against its being *coccidioides*. The organism was, in fact, definitely ascertained by morphologic and cultural criteria to be *Blastomyces dermatitidis* (Gilchrist and Stokes, 1898).

Treatment.—The primary treatment consisted of surgery for the osteomyelitis. In addition, sulfanilamide and sulfathiazole were administered locally and orally for 1 month, maintaining the usual therapeutic blood levels. These measures were ineffective since the condition of the bone, lungs, and skin showed a continuous extension and progression of the infection and the patient continued to have fever.

Iodides were given in therapeutic doses in the form of saturated solution of potassium iodide orally, 10-percent sodium iodide solution intravenously, and tincture of iodine locally, for a period of another month without any apparent benefit. Phenylmercuric nitrate, chemical coagulants, and other drugs



2. Culture of blastomyces illustrating budding formation.



3. Culture of blastomyces revealing hyphae formation.

were tried locally without any abatement of symptoms. Ultraviolet rays and various supportive measures failed to change the status of the condition.

On 15 November 1940, ether was applied locally to the skin infection of the arm and used to irrigate the osteomyelitic infection of the bone and the skin wounds of the foot. In addition, 4 ounces of ether in an equal amount of oil were given rectally after a soapsuds enema, on 9 consecutive days. There was marked improvement. The temperature subsided and remained normal, the discharging pus from the foot diminished, and the skin lesions of the elbow for the first time became smaller. An x-ray of the chest at this time showed a diminution of the multiple opacities in the lungs.

The rectal ether and oil was thereupon given every other day for 1 week and then once weekly until the patient was discharged from the hospital on 25 February 1941. Under this new treatment she showed a constant improvement. The bone and wounds of the foot as well as the cutaneous lesions of the elbow healed completely. The palpable lymph nodes of the arm and leg entirely disappeared. X-ray films of the chest demonstrated a resolution of the pulmonic lesions. There was no evidence of any infection when the patient was discharged from the hospital.

On 17 January 1944 the patient expired after taking an overdose of sleeping tablets. An autopsy revealed barbiturate poisoning with barbiturate crystals in the liver and kidneys and a terminal bronchopneumonia. There was no evidence of blastomycosis or any pathologic effects from the ether previously administered.

CONCLUSIONS

1. A case of systemic blastomycosis in a usually fatal form failed to respond to sulfonamide therapy or iodides. Following a new form of therapy the patient recovered without any recurrence during 26 months of close observation.

2. An autopsy, performed for another condition 26 months after the ether treatment, revealed no evidence of any blastomycosis and no toxic effects from the use of this drug.



NITROGEN BALANCE BY PLASMA AND PROTEINS

Nitrogen balance may be achieved both in animals and man by the intravenous administration of compatible plasma as the sole source of nitrogen. Nitrogen balance can similarly be maintained by the intravenous injection of solutions containing mixtures of all of the essential aminoacids or certain protein hydrolysates.—ELMAN, R.: Maintenance of nitrogen balance by intravenous administration of plasma proteins and protein hydrolysates. *Physiol. Rev.* 24: 372-389, July 1944.

PSORIASIS FOLLOWING PRICKLY HEAT

ROBERT R. M. McLAUGHLIN
Lieutenant Commander (MC) U.S.N.R.

It is commonly observed that psoriasis is a skin disease that runs a cyclic course, and that it is usually at a low clinical ebb during the summer months and in warm climates. However most of us have observed cases that do not follow this usual course. The primary appearance of psoriasis as an eruption superimposed on prickly heat, while readily explained, is thought to be unusual, and particularly interesting since the patient had been in the tropics for only a few weeks, and gave no history of previous attacks of the eruption.

Case report.—The patient, a 25-year-old white male, stated that he had developed a severe case of prickly heat during his first week of duty in the tropics. He was given local applications of calamine lotion with some subjective relief of symptoms but the skin rash failed to subside. Instead the lesions changed in appearance from small, red, itchy, conical papules to larger, darker red, less pruritic, elevated papules covered with a silvery, adherent scale. At the same time redness and scaling were noted on the extensor surfaces of the elbows and knees. The change was complete in about one week.

There was no history of previous skin trouble in the patient or his immediate family, nor was there a familial history of arthritis, diabetes or gall-bladder disease.

Physical examination on admission showed an unusually widespread acute psoriasis. The papules were of a strikingly uniform half-centimeter size, tended to be discrete, except on the flexor surfaces, and, although they were generalized in distribution, there was a tendency to grouping on the neck and supraclavicular areas, the lateral lumbar areas, and about the waist. These areas are probably the commonest affected by prickly heat. Over the extensor surfaces of the elbows and knees, the lesions were confluent and formed the usual irregular plaques of psoriasis, with the characteristic adherent silvery scale. The scalp, nails, palms, soles, face, axillae and perineal areas were free of the eruption.

Response to treatment with a prickly heat lotion was immediate and pronounced. This lotion consisted of:

	<i>Gm. or cc.</i>
Menthol	0.25
Alum	1.00
Tincture of iodine.....	5.00
Spirits of camphor.....	20.00
Alcohol (70%) qs.....	100.00

At the end of one week, a liquid tar solution was used for the more resistant areas, and only traces of the eruption were present at the end of 2 weeks of treatment.

This patient was evacuated to a cooler climate since it was considered probable that the psoriasis would recur promptly under duty conditions, and would become a severe widespread and disabling eruption.

MEDICAL AND SURGICAL DEVICES

CYSTOSCOPIC CLINIC AT AN ADVANCE NAVAL BASE HOSPITAL

HARRY M. SPENCE

Lieutenant Commander (MC) U.S.N.R.

The purpose of this communication is to report experiences in establishing and running a cystoscopic clinic at a Naval base hospital in the South Pacific. The need of such a clinic is definite because of the significant incidence of small ureteral calculi encountered in this area, and omnipresent backache problems, and the necessity for being prepared to diagnose injuries of the urinary tract in battle casualties.

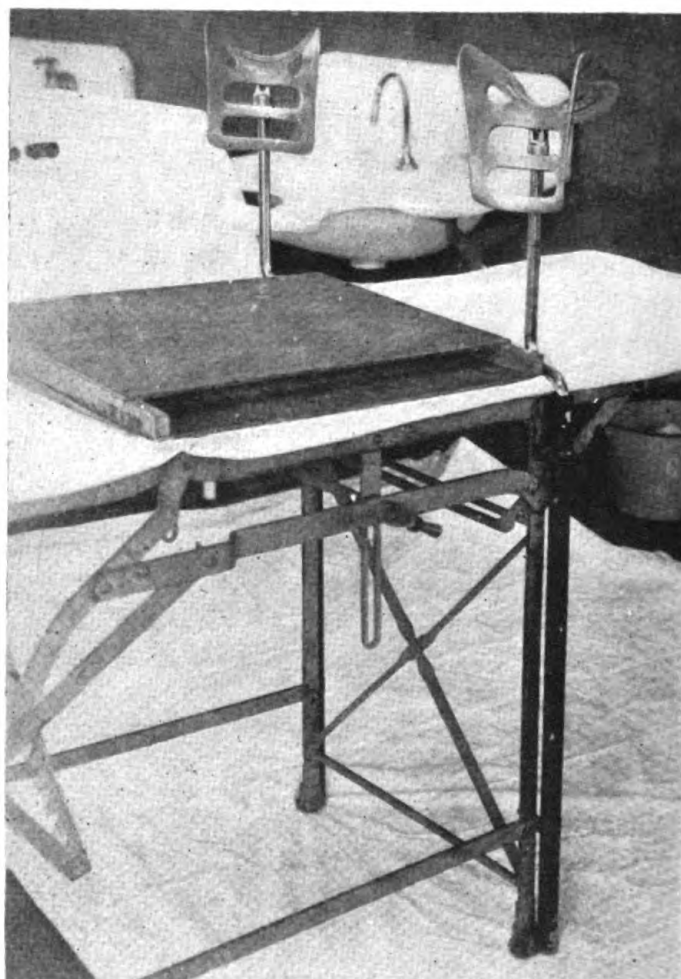
The equipment provided, although not extensive, is adequate if certain simple improvisations are made. Our basis equipment consists of a small portable operating table, a complete cystoscope, an assortment of No. 5 and No. 6F ureteral catheters, skiodan powder and the usual accessory syringes, sterilizers, linen and so forth.

For taking urograms the x-ray department is provided with a portable machine and grid, but no moving Bucky diaphragm. The limited supply of film available makes rigid economy necessary. For this reason and because the diodrast supply is scant, excretory urography is done only where ureteral catheterization is not feasible. The cystoscopy room occupies a space 16 by 20 feet in a Quonset hut adjacent to the x-ray department.

The small portable operating table has no provision for the lithotomy position but by fastening two 30-inch lengths of $\frac{3}{4}$ -inch pipe to the foot of the table, receptacles for leg holders may be furnished. The latter come with the large general operating table but if not available they may be readily constructed from rod stock.

A plywood cassette holder, which is placed under the patient, provides a convenient method for centering and changing the film without moving the patient off the table. When the catheters have been passed, the portable x-ray unit is wheeled into position and the exposures are made.

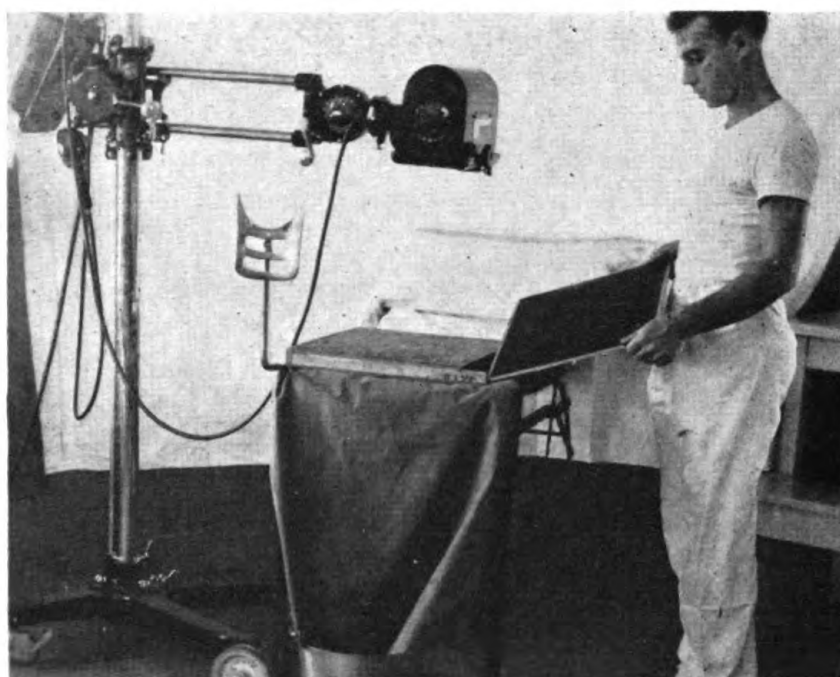
A substantial saving in the number of films used may be effected by gently injecting 8 cc. of air up each catheter immedi-



1. Improved cystoscopy table showing leg holders and plywood cassette tunnel for Lysholm grid and cassette. The tunnel is made of $\frac{1}{4}$ -inch plywood and accommodates 14-inch by 17-inch film.

ately before exposing the first film, thus combining the plain film and pyelograms on one plate. This procedure is particularly adapted to the case in which upper urinary tract involvement is not strongly suspected but must be ruled out. We have encountered no untoward effect from air pyelography in considerable experience both in private and hospital practice. Of course if the air pyelogram is inconclusive or unsatisfactory, skiodan is injected in the usual fashion.

Renal colic.—Our experience is in accord with that of other urologists in this area in that there is a disproportionately high incidence of small ureteral calculi with attendant renal colic. This finding is perhaps related to the combination of excessive perspiration and restricted fluid intake occasioned by the common aversion to imbibing sufficient amounts of tepid, strongly chlorinated water. Be this as it may, we feel that a complete urologic



2. Portable x-ray unit. Placing Lysholm grid.

investigation is indicated in such cases of renal colic and this should be done at the advance base hospital rather than to evacuate such patients to the rear area. Small calculi may be dislodged readily by simple catheter manipulation, and roentgenographic evidence of a normal or abnormal upper urinary tract puts the question of evacuation or return to duty on a rational basis.

Lumbar backache.—Incapacitating lumbar backache, often unilateral, is a frequent complaint among Marines sleeping on the ground, the older age group composing construction battalions, aviation ground crews and so forth. The cause of the backache is often obscure and urologic consultation is requested if the orthopedic examination is inconclusive. In such cases our first step is to rule out the prostate as a focus of infection. If further study is indicated we then do a cystoscopy with ureteral catheterization and pyelography. The time and supplies expended are negligible when compared to the information obtained on which an intelligent, definite opinion may be rendered.

Battle casualties.—The incidence of urinary tract injuries in World War I was comparatively small and it is our impression that the same holds true in the present conflict. Nevertheless the possibility of receiving such cases in this type of hospital is ever present and is an additional reason for having a well organized cystoscopic clinic.

SIMPLIFIED METHOD FOR INDIRECT BLOOD TRANSFUSIONS

SAMUEL J SCHNEIERSON
Lieutenant Commander (MC) U.S.N.R.

In indirect transfusions of whole blood a number of methods are employed for the collection of the blood from the donor and its delivery to the patient. Some of the special devices used are at present issued in units, complete in themselves. It is believed, however, that the following system has several advantages. They are:

1. Economy and availability of material used in construction of the device. Some of the material discarded from used plasma units may be utilized.

2. Simplicity of operation. The transfusion can be completed by a hospital corpsman working alone.

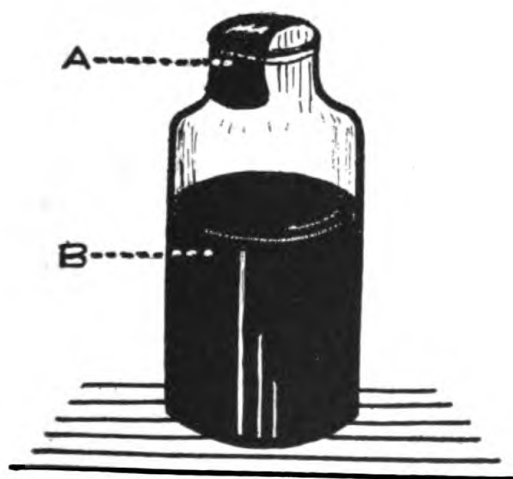
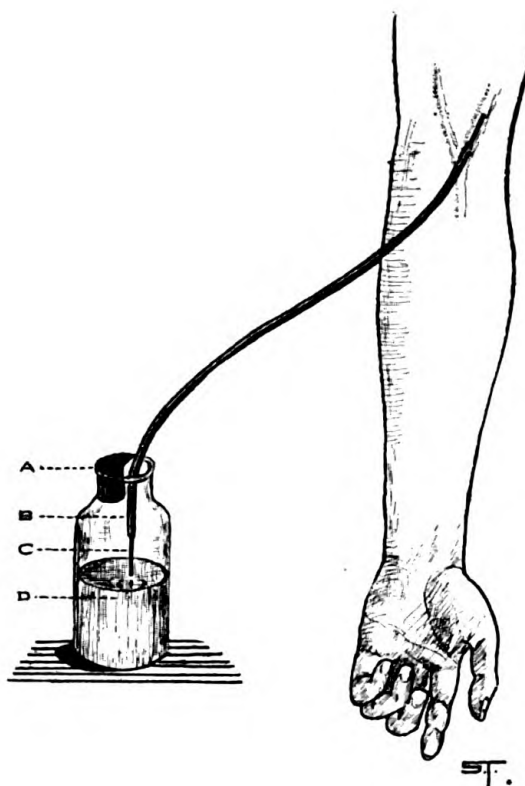
3. The method is relatively foolproof.

This unit was quickly improvised at a time when we had many transfusions to do and the limited number of proprietary units of this facility was temporarily exhausted. Heretofore the water bottles of plasma units have been discarded when emptied. The interior of these bottles is still sterile after they have been emptied in the usual manner. They (or any large sterile bottles) are used in this method for the collection of blood from the donor. The remainder of the equipment is easily obtained at any medical activity.

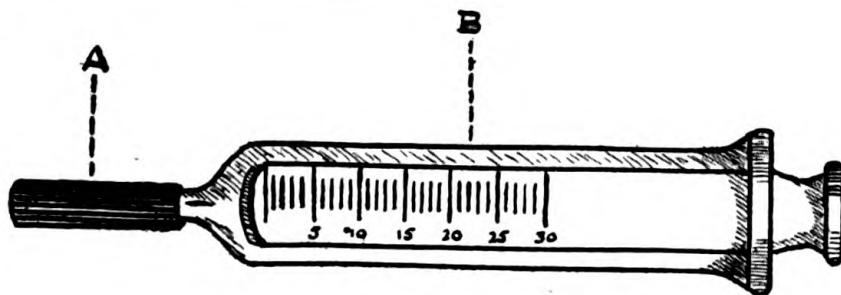
As shown in figure 1, blood is collected by the gravity method, the proper solution of sodium citrate first being poured into the bottle. For this step the stopper of the bottle may be removed or cut in half longitudinally and replaced, leaving enough space for the collection tube and an air space about it. For the sake of simplicity this bottle will be called the ready bottle.

For the delivery of the blood to the patient, ordinary tubing of the intravenous set is connected on one end with a piece of glass tubing large enough to extend from the bottom of the ready bottle through the neck, to the outside. The other end is connected with a glass adapter which fits the intravenous needles. The glass tubing can be made to curve around the bottleneck by simply bending it in a flame. This combination, glass tube, rubber tubing and adapter, is called the delivery system.

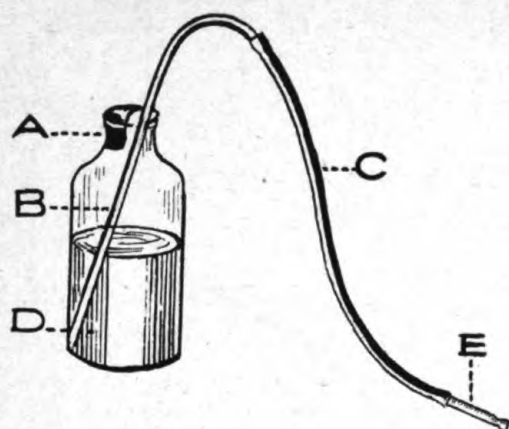
1. Collecting blood by gravity method.
A. Half stopper.
B. Rubber tubing.
C. Incoming blood.
D. Citrate solution.



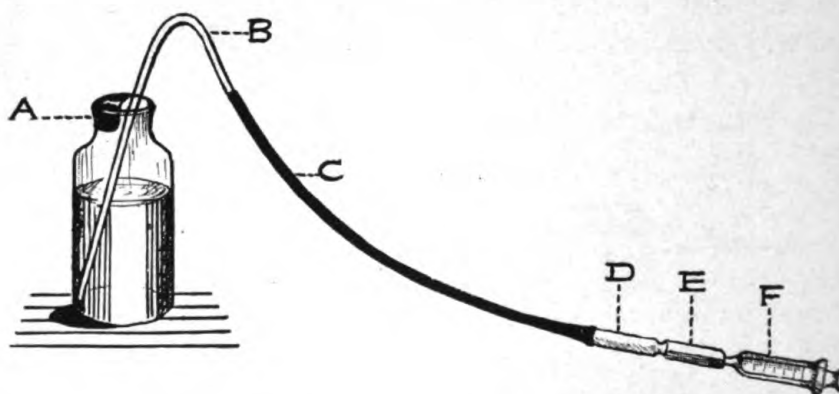
2. Plasma water bottle containing citrated blood. **A.** Half stopper. **B.** Citrated blood.



3. Syringe with 2 inches of rubber tubing, constituting the aspirator.



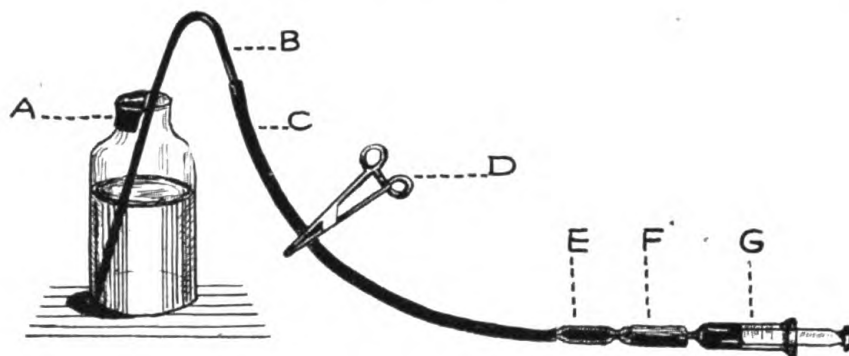
4. Ready bottle with delivery system in position. **A.** Half stopper. **B.** Glass tube. **C.** Rubber tube. **D.** Citrated blood. **E.** Glass adapter.



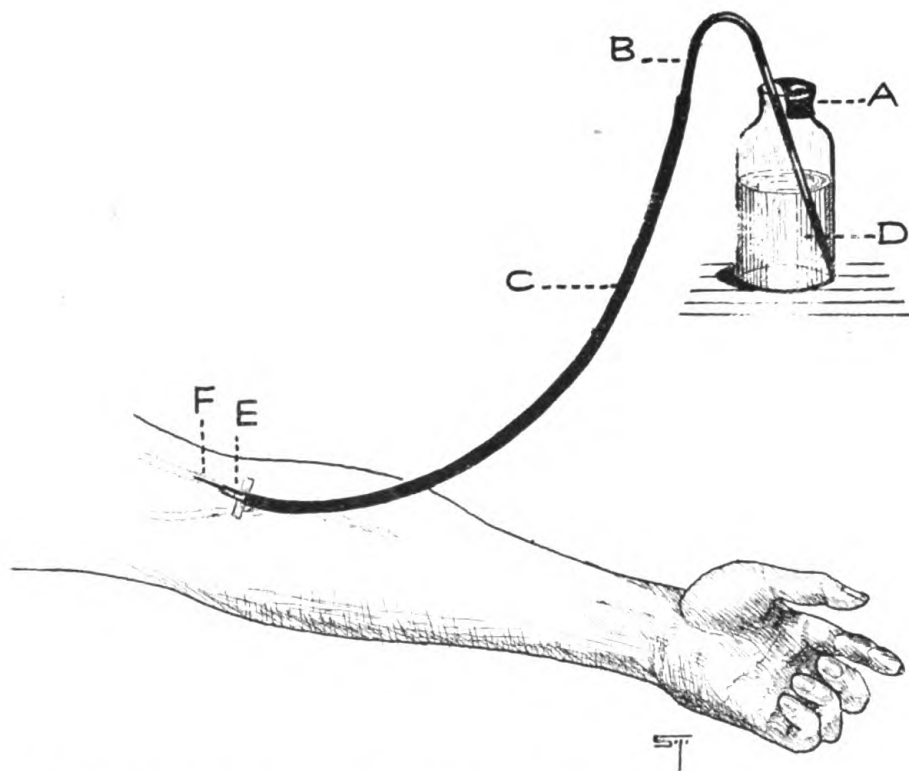
5. The plunger of syringe (**F**) is withdrawn until a few cubic centimeters of blood appear in barrel of syringe. **D.** Glass adapter. **E.** Two-inch rubber tube.

The glass tube of the delivery system is now placed in the bottle of citrated blood, the end of the glass tube touching the bottom of the bottle (fig. 4).

A 20-cc. or 30-cc. syringe, connected to a 2-inch length of rubber tubing is called the aspirator (fig. 3). The short rubber tubing, really the end of the aspirator, is then connected to the adapter of the delivery system (fig. 5). The plunger of the syringe is then drawn out slowly. As soon as several cubic centimeters of blood have been drawn into the syringe the rubber tubing is pinched off at any convenient point. As soon as the needle has been inserted into the vein of the recipient, the adapter can be connected with it, and the blood will flow as soon as the rubber tubing is unclamped (fig. 6).



6. The delivery system filled with blood. The rubber tube has been clamped.
 D. The adapter (E) can now be disconnected from rubber tube (D) and be inserted into needle already in the vein.



7. Blood flowing into vein. The glass adapter (E) has been slipped into needle (F). The bottom of bottle should be $1\frac{1}{2}$ to 2 feet above needle.

The one precaution necessary is that *under no circumstances is the end of the delivery system to be raised above the level of the blood in the bottle*. If this rule is violated, however, the aspirator can again easily be used to reestablish the siphon as described above.

For convenience the bottle can stand on some firm makeshift object so that it will be 2 to $2\frac{1}{2}$ feet above the level of the

patient's vein. If it is desired to accelerate the speed of the flow, the bottle can stand at a still higher level.

The plasma water bottle will hold about 300 cc. of blood. When one bottle is almost empty, another one can be substituted by simply pinching the rubber tubing of the delivery system and transferring the attached glass tube to the full bottle. In this way as much blood can be given a patient at one time as is desired.

If the operator wishes to insert a Murphy-drip or other dropper device in the delivery system it can easily be done by dividing the rubber tube of the delivery system and inserting the dropper. If a drip device with a hole is used, the hole must first be plugged. If a blood filter is desired, it can be inserted in the same way.



X-RAY GAS GANGRENE

In wounds caused by high-speed projectiles the extent of the damage is seldom as defined, or the depth of bacterial contamination as limited as most writers on war surgery suggest. The entering missile carries before it a cushion of compressed air that may spread widely in the limb, giving rise to the familiar diagnostic error of "X-ray gas gangrene," and may pulp soft tissues well beyond the missile's track by the explosive effect of blast. Hemorrhage, exudate, the changed direction of the track with the changed position of the limb, all tend to distribute foreign matter along the areolar planes.—Editorial. Wound excision and wound trimming. *Lancet* 1: 665-666, May 20, 1944.



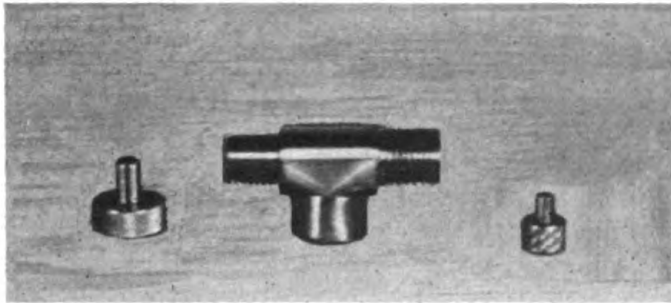
SULFANILAMIDE AND SODIUM BICARBONATE

Sulphanilamide tends to cause a shift in the reaction of the body fluids toward the acid side, bicarbonate being lost from the blood. It has been shown that this effect is primarily due to the renal excretion of more bicarbonate (i.e. the kidney cells re-absorb less bicarbonate from the glomerular filtrate as it flows down the tubules); while the hyperpnoea and loss of carbon dioxide from the lungs is a secondary compensation. Accordingly, this effect can be corrected for clinical purposes by giving sodium bicarbonate in doses equal to those of sulphanilamide. There is some evidence that this action of sulphanilamide may possibly be connected with the ability of sulphanilamide to inhibit carbonic anhydrase, the enzyme which catalyses the liberation of carbon dioxide from the carbonate of the plasma.—HAWKING, F.: Recent work on pharmacology of sulphonamides. *Brit. M. Bull.* 2: 64-70, 1944.

CONSERVING WATER IN SHIPBOARD DENTAL OFFICES

MACK MERADITH
Commander (DC) U.S.N.

The conventional type of saliva ejector in the modern dental unit employs water-induced suction. It is satisfactory in operation but aboard ship will arouse the ire of the chief engineer as he sees fresh water going down the drain. Obviously the use of salt water is impractical because of its corrosive action. However, the motor-driven aspirator which is a part of the majority



1. T fitting and metal plugs.



2. Showing fitting attached to aspirator bottle.

of dental units afloat furnishes a satisfactory substitute for the water-suction method.

It is only necessary to connect this motor-driven suction system to the saliva ejector and eliminate the water suction entirely. The apparatus necessary for this conversion is simple and can be made in any shipboard machine shop. It consists of a T fitting (fig. 1) which attaches to the aspirator bottle as shown in figure 2, and two metal plugs for insertion into the aspirator or saliva ejector, whichever is not in use, to maintain suction.

Practical tests have demonstrated that this device, based on an average of 1½ hours' use daily will save 90 to 100 gallons of fresh water for each dental unit. This is considered sufficient to establish its definite value in fresh water conservation aboard ship.



NONTROPICAL SPRUE SYNDROME

Sprue goes by a number of names, including "sprue," "nontropical sprue," "celiac disease," and "idiopathic steatorrhea." A geographical distinction is the only real difference between the tropical and nontropical forms of the disease. Celiac disease is generally considered the sprue syndrome occurring among children and bears the same relation to sprue that cretinism does to adult myxedema. Even in normal persons, fats are absorbed less readily than are proteins, and carbohydrates are absorbed more easily than either of the other two foodstuffs. In sprue, therefore, in which the primary disturbance is an absorptive deficiency, it is readily understandable that inadequate absorption of fat should be responsible for so many of its symptoms.

In the active stage of the disease stools are frequent and are said to be bulky, greasy and foamy, but just as often may be liquid and brown or they may have the appearance of dirty dishwater.

That vitamin K is improperly absorbed is evidenced by the frequency of the hemorrhagic diathesis and by the finding of an elevated prothrombin time, when the disease is active.

The metabolism of calcium may be interfered with, and it is probable that all substances, even water and gases, are absorbed poorly.

That the vitamin B complex is grossly deficient is evidenced by the frequency of appearance of such symptoms as cheilosis, angular stomatitis, pellagra-like lesions of the skin and a fiery red tongue. The vitamin C content of the plasma is significantly lowered.

A hyperchromic macrocytic or a hypochromic anemia characteristically accompanies sprue.—WILDER, R. M., JR.: Nontropical sprue syndrome: Report of four cases and of case in which intestinal insufficiency was corrected by operation. Proc. Staff Meet., Mayo Clin. 19: 297-302, June 14, 1944.

MOBILE SURGICAL UNIT SETUP

DONALD E. DEMENT
Commander (MC) U.S.N.R.

This equipment is maintained in readiness at all times, to have it available in the event of a major catastrophe.

The setup consists of three boxes of supplies, containers for sterile water, and portable lamps. Separate boxes contain blankets and sheets. Two Army-type portable operating tables, litters, both Army and Stokes, and Army cots are included. The containers for water are ordinary ten-gallon milk cans with a faucet



Official U. S. Navy Photo.

Emergency mobile surgical unit setup.

welded into the lower rim. These can be filled with sterile water and the necessary amount of tincture of iodine added to keep it sterile.

Both the boxes and milk cans are painted gray, with large red crosses stenciled on them. The lamps are portable operating lamps which run either from ordinary current or from self-contained batteries which will last approximately 6 hours. The boxes of supplies and cans are kept in a special locker in the garage so that they may be immediately loaded into ambulance or truck. The locker is secured with a padlock, one key of which is kept on the dispensary keyboard, the other on top of the locker in a small frame under glass. In order to get this key it is necessary to break the glass.

In case of a call it is only necessary to pick up sterile instruments, trays and lamps from the operating room, fill the cans with water and load everything into one or more of the vehicles. The average time required for this would be approximately 10 minutes from the time the call was received until the unit could be under way.



MARFANIL

Marfanil, a German preparation, is 4-aminomethylbenzene sulphonamide. It differs from sulphanilamide and the other common sulphonamides in having the amino group separated from the benzene ring by a methyl group.

It is a much weaker bacteriostatic agent on test streptococcus than sulphathiazole, but is not inhibited by *p*-aminobenzoic acid or pus.

Of the many substances tested in the treatment of infected wounds penicillin alone has given better results than marfanil. At present for technical reasons it may prove easier to produce marfanil in much larger amounts than penicillin, and thus, even though the former is less effective, further investigation of marfanil is indicated. It is possible also that penicillin used in conjunction with marfanil may give better results than when it is mixed with sulphanilamide or sulphathiazole.—MITCHELL, G. A. G.; REES, W. S.; and ROBINSON, C. N.: Marfanil and marfanil prontosilbin. *Lancet* 1: 627-629, May 13, 1944.

EDITORIALS

REHABILITATION

The vastness of the rehabilitation program can be measured only by the magnitude of the war. To return men to a useful military status in the quickest possible time is the immediate goal. It is not the only aim, however. The over-all scope is more far-reaching and goes beyond the care of those who are militarily redeemable.

Its purview includes long-term convalescence as well as care of irreversibles. Where the one ends and the other begins is a matter of administration; the fact of rendering the service, however, is established.

Rehabilitation is predicated on early recovery, convalescence, and return of the individual to military duty. It is primarily a medical mission and begins at the moment of casualty. While rebuilding the disability, the medical officer endeavors to arouse in the individual confidence in the future, a desire to get well, and an interest in resuming military activity.

Any divorce of this twofold aspect dooms rehabilitation to failure. As Braceland points out, p. 621, it is the man as a feeling person who will recover from the illness, who will wear the orthopedic appliance and as such it is the person as a whole who should be treated. *Mens sana in corpore sano* is an ideal of rehabilitation, but it is only one aspect of the problem.

The fundamental characteristic of life is activity. An organ reduced to inaction withers and disintegrates; even so the organism as a whole. Appreciation of this principle forms the basis of early reconditioning, the reduction of hospital stay and the elimination of a period of idleness of body and mind.

When the nature of the trauma precludes reconditioning for resumption of military service, convalescence is planned toward return of the individual to civilian life.

Vocational rehabilitation has prepared him for an occupation physically and mentally suitable to insure adequate maintenance. Rehabilitation implies acceptance of a handicap on the part of the disabled in relation to his social environment. But this latter introduces the most difficult task of any rehabilitation program.

To acquaint the public at large with the usefulness of a partially disabled person calls for resourcefulness of propaganda

proportions, whereas acceptance of such a person by the public connotes a renaissance of ideals. The psychologic barrier which the returning veteran has hurdled in adapting himself to his changed circumstances, experienced as he is in the knowledge of the public's indifference to the disabled, has been a colossal personal triumph. But more stupendous is the task of influencing public opinion toward his employment.

As Braceland has indicated, with competition for postwar jobs keen, any preference in employment of the handicapped over the completely healthy individual is untypical of modern commercial practice. But any program dedicated to general rehabilitation which will not have broken down this attitude falls short of its desired end.

MEDICAL VS. SURGICAL MANAGEMENT OF ACUTE APPENDICITIS

The announcement¹ of the results of penicillin-treated gangrenous appendix vermiformis in dogs revives the discussion of medical vs. surgical management of acute appendicitis.

The recent reports² of appendectomies under adverse circumstances by unskilled personnel have shocked the surgeon into acquiescing to a guarded medical management of acute appendicitis.

From a surgeon's viewpoint, appendicitis is strictly a surgical problem. From experience he has learned the seriousness of procrastination; when the cardinal signs are elicited, delay in the removal of the appendix is fraught with disaster. This precept he has accepted as sound surgical practice.

It was not always so, however. The heated debate of several decades ago showed a divided opinion. The influence of the Ochsner school is felt even down to our day. There are still some who staunchly hold to the principles of medical management of appendicitis and who claim that a diagnosis of appendicitis does not necessarily call for surgery, particularly when the history portrays an initial attack. Operative expectancy, it is held, under these conditions is permissible.

¹ FAULEY, G. B.; DUGGAN, T. L.; and STORMONT, R. T.: Use of penicillin in treatment of peritonitis; experimental study (lantern demonstration). Read before Pathology Section, American Medical Association Convention, Chicago, Ill., June 12-16, 1944.

² Notes, Comments and Abstracts. Appendectomies by hospital corpsmen. Hosp. Corps Quart. 16: July 1943.

The wide success of sulfonamide in inflammatory processes has not helped to discourage this view. Reports³ of the successful employment of sulfonamides under such circumstances at sea have been cited as instances confirming the reasonableness of this stand.

Under wartime Naval conditions it is conceded that situations may exist whereby surgical intervention is not only hazardous but contraindicated. This is intelligible, but the risk is admitted.

It is partly to cope with these situations that Fauley undertook the experimental use of penicillin therapy in appendicitis. By cutting off the vascular supply to the appendix in the dog and ligating it at its base with a strong ligature, he was able to produce not only a gangrenous appendix but a complicating fulminating generalized peritonitis. Approximately 93 percent of the control animals died. The penicillin-treated animals however showed a 100-percent survival. Subsequent autopsies of these revealed not only no evidence of peritonitis but exhibited an obliterated and absorbed appendix.

Although enthusiastic over the outcome of the necessarily limited number of experimental cases, Fauley does not advocate resort to penicillin in preference to surgery. He specifically states that in his opinion the ideal management of acute appendicitis is surgical, and offers his research contribution as a compromise when conditions adverse to surgery prevail.

MASS CHEMOPROPHYLAXIS

The present war appears to have escaped pandemic disease. However in a recent monograph¹ there is told the remarkable check of a hemolytic streptococcal outbreak that aspired to pandemic proportions.

Early in 1943 following a relatively circumscribed incidence of measles in a certain Naval training center many serious types of respiratory infections occurred. These were traced to a hemolytic streptococcus which not only maintained its pathogenicity but manifested an increased virulence. It became highly communicable, produced intense scarlet fever, precipitated severe rheumatic attacks and became invasive. The bacteria identified serologically as types 17, 19, and 1 maintained their patho-

³ BERKLEY, W. L., and WATKINS, H. C.: Chemotherapy in management of acute appendicitis. U. S. Nav. M. Bull. 42: 1-6, January 1944.

¹ NAVMED 284. The Prevention of Respiratory Tract Bacterial Infections in the United States Navy by Sulfadiazine Prophylaxis.

genicity when transplanted to other sections of the country and even initiated streptococcal outbreaks at activities situated in the Southern states.²

The seriousness of the situation was recognized early and was met with the institution of a long term streptococcal control program.

What may be considered the outstanding medical contribution of the year emerged from this program.

Evaluation of the therapeutic effectiveness of any drug taxes the ingenuity of the most skilled. Control of the many variables often verges on the impossible. Besides a population factor of sufficient size to influence the percentage of error, the constitutional difference of living matter, its manner of response, environmental conditions and the peculiar characteristics of a drug often reduce an appraisal to a mere estimation.

An experimental population approximating 600,000, an equivocal environmental condition, and controlled particulars that only military situations can afford, validate the observations in this instance in a manner that will be difficult to duplicate in any experiment on living subjects.

Its objectives were achieved by the use of prophylactic doses of sulfadiazine. The effectiveness of sulfadiazine prophylaxis had been indicated in previous reports^{3, 4, 5, 6} but to test its mass applicability under controlled conditions and to determine a standard prophylactic dose, several activities seriously handicapped by a high incidence of respiratory infections were selected. The institution of 1 gm. daily to all hands was accompanied by a precipitous contraseasonal decline in streptococcal infections and was followed by a marked drop in the incidence of rheumatic fever.

Since the advent of chemotherapy, concepts regarding sulfonamides have had to undergo considerable modifications. Administration of subclinical doses has been considered conducive to drug sensitization, induction of severe, irreversible drug reac-

² COBURN, A. F.: The Prevention of Respiratory Tract Bacterial Infections by Sulfadiazine Prophylaxis in the United States Navy. Read before American Medical Association Convention, Chicago, Ill., June 12-16, 1944.

³ THOMAS, C. B., and FRANCE, R.: Preliminary report of prophylactic use of sulfanilamide in patients susceptible to rheumatic fever. Bull. Johns Hopkins Hosp. 64: 67-77, January 1939.

⁴ THOMAS, C. B.; FRANCE, R.; and REICHSMAN, F.: Prophylactic use of sulfanilamide in patients susceptible to rheumatic fever. J.A.M.A. 116: 551-560, February 15, 1941.

⁵ WATSON, R. F.; SCHWENTKER, F. F.; FETHERSTON, J. E.; and ROTHBARD, S.: Sulfadiazine prophylaxis in epidemic of scarlet fever. J.A.M.A. 122: 730-733, July 10, 1943.

⁶ KUHN, D. M.; NELSON, C. T.; FELDMAN, H. A.; and KUHN, L. R.: Prophylactic value of sulfadiazine in control of meningococcal meningitis. J.A.M.A. 123: 335-339, October 9, 1943.

tion and the development of drug-fastness in bacteria; employment over a prolonged period exposed the patient to blood dyscrasias.

These and other contentions were proved invalid during the course of this study. Dangerous untoward reactions occurred only once in 10,000 individuals receiving the sulfadiazine prophylaxis, and these consisted of an exfoliative dermatitis and granulocytopenia.

Drug-fastness was apparently not initiated by administration of the prophylactic dose despite the extended program of 6 months.

Thus mass prophylaxis with sulfadiazine becomes established and brings with it less serious sequelae than the administration of such a drug had led one to anticipate. Its effectiveness not only was apparent in the reduction of streptococcal invasion but materially influenced the incidence of meningococcal, pneumococcal and gonococcal infections.

The lessened morbidity and the saving of man-days have tremendous economic implications and recommend a continued use of this mode of prophylaxis.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

ORAL HISTOLOGY AND EMBRYOLOGY, edited by *Balint Orban*, *Foundation for Dental Research of the Chicago College of Dental Surgery, School of Dentistry, Loyola University*. 342 pages; 262 text illustrations, including 4 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$6.50.

Oral Histology and Embryology has evolved from the efforts of 18 contributors. Each of these is a leader in the field of research and teaching related to subjects covered by this text. Orban has edited and correlated the contributions from each of his coworkers, revising and assimilating all the efforts in a pattern applicable to formal educational courses as well as supplying a ready reference work for the graduate student or practitioner.

Beginning with the development of the face and oral cavity, well planned illustrations make possible a visualization of embryonic growth of each structure by the skillful use of colors which represent different structures in all the various stages of development from the third week of embryonic life to the full adult period. Thus each color can be followed through the 8 principal periods listed, correlating all the changes and greatly aiding in forming a comprehensive picture of this cycle of growth and maturation. The study of the development of the face, palate, and tongue is greatly aided by the comprehensive use of well selected illustrations which include the color plates previously mentioned, photographed tissue sections and well executed diagrams.

If Oral Histology and Embryology contained no material other than that found in chapters one to seven inclusive, it would justify its publication in the field of science. These chapters include the important considerations regarding the development and growth

of the teeth. In this consideration, the various stages of tooth formation during the different periods of growth, calcification, eruption and attrition are explained in detail and with clarity.

Following the chapter on general growth and development of the teeth, each structure is taken up in a separate chapter. In this way the results of important facts resulting from research and teaching are correlated and set forth for those who may seek this information. Enamel, dentin, pulp, cementum and periodontal membrane, are all taken up under this general plan for ready reference and study. Decalcified and directional ground sections assist in portraying the histologic nature of these various structures. Beautiful photomicrographs are worked into the pattern of instruction which enables good visualization of the exact form and nature of the various components.

A diagrammatic color plate of the embryo is used effectively showing cartilage, and intramembranous and intracartilaginous bones. The primary tissues are related to all osseous skull structures by means of designated colors, again following through growth stages with continuous relation to the embryonic development. The maxilla and mandible are fully covered. Interesting material relative to the physiologic changes in the alveolar process and internal reconstruction of bone is included.

The formation of and transient position of the gingival sulcus and epithelial attachment in relation to the clinical and anatomic crown at different stages of life is of interest.

The histology of tooth eruption is considered by classification into (a) preeruptive, (b) prefunctional and (c) functional phases. Very complete data are given on the chronology of the human dentition as well as interesting facts on the shedding and tooth eruption phenomena.

The salivary glands of man are exocrine glands, the primary function of which is to transform and secrete materials brought to them via the circulating fluids of the body. This function represents active work in producing and discharging complex substances, such as mucin and ptyalin, which are found in the circulating blood and lymph. Saliva is the term applied to the accumulated secretory and excretory products discharged by the salivary glands into the oral cavity. This is an important consideration, and Orban, by the use of well chosen photographs and illustrations, gives a clear picture of the location, size and function of the glands of the major and minor secretions.

The important facts relative to the temporomandibular joint and maxillary sinus are given adequate consideration.

A valuable feature of each chapter is the information classified under clinical considerations. Here the accepted histologic facts are related to actual diagnosis, treatment and operative procedures.

In its concluding pages under the heading of Technical Remarks, this text may be a valuable guide to those interested in the details encountered in the preparation of histologic specimens for study and research.

This text furnishes many good references in addition to its complete subject matter and is considered a valuable contribution to the literature.

ORAL PATHOLOGY, A Histological, Roentgenological, and Clinical Study of the Diseases of the Teeth, Jaws, and Mouth, by Kurt H. Thoma, D.M.D., Professor of Oral Surgery and Brackett Professor of Oral Pathology, Harvard University; Oral Surgeon and Chief of Dental Service, Massachusetts General Hospital. Second edition. 1,328 pages; 1,388 illustrations, including 128 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$15.

Essentially this book is a collection of original and derived material organized in twelve parts representing major lines of approach to the whole field of oral pathology.

Each of these parts is minutely developed in an encyclopedic manner by consideration of findings and writings of workers in practically every field of dentistry, medicine, and allied sciences.

In coverage this treatise ranges from an approach including a presentation of experimental, developmental, somatic, functional, traumatic, infectious, and neoplastic factors to specific discussion of the various diseases of the teeth, jaws, and associated structures.

Although its method of handling the subject is much broader in scope than is usually seen in works on dental or oral disease, there is no lack of detail with regard to features of immediate practical significance in either text or illustrations. Naturally that makes for a voluminous book regarded as suited better for use by students and research workers than by busy practitioners.

SYNOPSIS OF MATERIA MEDICA, TOXICOLOGY, AND PHARMACOLOGY, For Students and Practitioners of Medicine, by Forrest Ramon Davison, B.A., M.Sc., Ph.D., M.B., Formerly Assistant Professor of Pharmacology in the School of Medicine, University of Arkansas, Little Rock. Third edition. 759 pages; 40 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$6.50.

It is the reviewer's impression that a synopsis is a compact review of a subject from which much unnecessary detail and irrelevant material have been deleted. If so, the present volume

can scarcely fit such a definition. Including the index there are 759 pages, somewhat over fifty lines to the page and ten words in each line. On a liberal allowance of blank pages and paragraphs, there are well over 300,000 words in this text. Actually, the print is too small and there are too many lines on each page.

In a consideration of the material, there is much which is good and some which is questionable.

Regarding the latter, when the author makes a dogmatic statement in opening a paragraph, it is assumed that he does so to eliminate further unnecessary discussion. Professor Davison would be better off to avoid the practice of reopening his subject in order to add remarks of questionable value. The occasional historical passages are of little worth. There is no need in this type of book for a section on food poisoning, under toxicology, or of a method for the determination of vitamin-K deficiency, in the chapters on vitamins. It seems rather fruitless to utilize space in offering favorite prescriptions or to enlarge on entities which will cause coma, delirium, tachycardia, nausea, and vomiting other than the poisonous drugs under consideration.

A bibliography is appended at the end of each chapter. The selections are satisfactory, though there is too much reliance upon associated volumes. There has always been some doubt as to the need of a bibliography in a synopsis.

In the next edition, it is hoped that the writer will make adjustments, as the remainder of the text is satisfactory. Charts, diagrams and tables are selected with care. The section on toxicology will aid greatly in this complex field. No tendency is noted to recommend any particular drugs or other forms of medicinal therapy.

There are comprehensive reviews of gramicidin, penicillin, the endocrines and the sulfonamides. In addition, the older and tried remedies have been allotted adequate space. No personal recommendations are noted.

The arrangement of material is laid out well, the paper is of good grade, and the binding is stout.

STROPHANTHIN, Clinical and Experimental Experiences of the Past 25 Years, by *Bruno Kisch, M.D., Formerly: Professor on the Medical Faculty of Cologne University (Germany), Visiting Professor to the International University in Santander (Spain), Research Fellow at Yale University.* 158 pages; 24 figures. Brooklyn Medical Press, Inc., New York, publishers, 1944. Price \$4.

Dr. Kisch deplores the infrequent use of strophanthin in America in heart disease as compared to certain European countries,

notably Germany. He states the drug has fallen into disrepute in America chiefly because of misleading statements in the literature emphasizing the toxic effects more than the beneficial ones. He feels strongly that "an ethical obligation exists for every physician to become acquainted both theoretically and practically with this life-saving drug."

Dr. Kisch's book devotes 66 pages to the pharmacology and 34 pages to clinical experiences with strophanthin. The reviewer doubts its value as a standard reference because of its laborious English and its lack of a good index. The former was a discouragement to me, a clinician, as I tediously waded through the book to pick out a few choice morsels. Perhaps it may have more appeal to the physiologist and pharmacologist, particularly those who in their research require a knowledge of what a drug will not do as well as what it will do.

From the reviewer's viewpoint, the chief information to be derived from this book is that there is a suitable maintenance as well as an emergency dose of the drug, and that the clinician who knows this and the signs of toxicity may administer strophanthin with a reasonable margin of safety. Dosage is given in detail, and toxicity is discussed at length.

The author's ideas on employing strophanthin in shock, and in angina pectoris and coronary thrombosis without congestive failure, appear revolutionary, if not indeed heretical. It also appears he has allowed his enthusiasm to let him lose sight of digitalis, the drug of choice in most cases, the exception being strophanthin in the hands of those few who are thoroughly conversant with its pharmacology.

MEDICINE AND THE WAR, by 11 members of the faculty of the Division of the Biological Sciences of the University of Chicago; edited by William H. Taliaferro. 193 pages. The University of Chicago Press, Chicago, Ill., publishers, 1944. Price \$2.

This volume is a compilation of a series of ten lectures delivered during the spring of 1943 by members of the faculty of the Division of the Biological Sciences of the University of Chicago. Its purpose is a most ambitious one: To present the panorama of military medicine to a well-informed laity.

On the whole, the essayists have done a most creditable job considering their limitations. Paul R. Cannon's subject "Food in the War" is a felicitous treatment of the background of the problems confronting UNRRA (United Nations Relief and Rehabilitation Association). "Malaria" by W. H. Taliaferro and "Insects, Disease and Modern Transportation" by C. G. Huff are lucid thumbnail sketches of the big medical and epidemiologic

problems in World War II. Henry Rickett's discussion of "Aviation Medicine" deals with the peculiar physiologic problems which confront workers in that field. The major military aspects of the fields of neurology and psychiatry are reviewed by Walker, Halstead, and Slight. Lectures entitled "Chemotherapy," "Shock and Blood Substitutes" and "Chemical Warfare" are also included. Luckhardt's historical résumé could have been elaborated with profit.

Admittedly, this is a picture of "woods" and not "trees." That it does not portray details is to be expected. What it does do is to point out the significant role which medicine plays in logistics.

SYNOPSIS OF OBSTETRICS, by *Jennings C. Litzenberg, B.Sc., M.D., F.A.C.S., Professor Emeritus of Obstetrics and Gynecology, University of Minnesota Medical School, Minneapolis.* Second edition. 405 pages; 175 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1943. Price \$5.

There is no synopsis which can completely replace a good text; however this little book very adequately fulfills the purpose for which it was written. It measures 5 x 8 inches and is bound with dark green cloth.

Of necessity any history or theory and nonessential detail are omitted, but each subject matter treated is surprisingly complete, with increased space given to many of the more important subjects, such as toxemias of pregnancy, contracted pelvis, hemorrhage and pathology of the puerperium. Placentation is beautifully and completely outlined. In operative obstetrics timely warnings are inserted.

I would highly recommend this book for quick reference or review by the student or physician.

A TEXTBOOK OF ANATOMY AND PHYSIOLOGY, by *Catherine Parker Anthony, B.A., R.N., Instructor of Anatomy and Physiology, Lutheran Hospital, Cleveland, Ohio.* 400 pages; 153 illustrations, including 8 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$3.50.

This teaching book presents the basic facts of body structure and function in outline form for use by students of nursing.

Study outlines, diagrams, pictures, summaries and review questions are used advantageously as learning aids in this concise volume.

THE CHEMISTRY OF SYNTHETIC SUBSTANCES, by *Dr. Emil Dreher.* 103 pages. Philosophical Library, Inc., New York, publishers, 1943. Price \$3.

As originally proposed by the author, the book is not a scientific text or reference book; it is merely an introduction to the subject of high molecular weight compounds.

While the book may have served its purpose in the original German, the strict literal translation followed by the translator makes the subject matter difficult to follow and obscures the few scientific facts presented. Since there are other more detailed texts available on the subject which contain more technical information and are written in better form, we can see no purpose gained in recommending it for either restricted or general issue.



CHIN SUPPORT



Immediate stabilization of a fracture involving a mandible or maxilla is necessary in order to reduce pain and shock and to avoid recurrent hemorrhage. Many types of external support have been devised, some simple and others quite complicated. It has been our experience that any stabilizing support that does not have elasticity incorporated in it soon loosens and thus loses part of its efficiency. This is even true

of the so-called elastic bandages.

We have been using a simple sling beneath the jaw connected to a skull cap by elastic bands. The skull cap can be obtained from the operating room and the sling quickly made by the hospital seamstress. Buttons, hooks or even safety pins can be used as anchors for the elastic bands. This support has been used with good results on fractures of the maxilla without intra-oral splints. It has also been used on fractures of the mandible both with and without intra-oral splints.

The advantages of this support are:

1. The cap and sling are easily and quickly made.
2. It is simple to apply.
3. The tension is easily changed.
4. The support does not loosen.
5. It may be taken off instantly in case of an emergency.—THUSS, C. J.: Simplified chin support. *J. M. A. Alabama* 13: 387-389, June 1944.



PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS ADMINISTERED IN THE UNITED STATES NAVY
IN 1943, WITH SPECIAL REFERENCE
TO ARSENICAL DERMATITIS

T. J. CARTER

Captain (MC) U.S.N.

WESLEY M. CHAMBERS

Lieutenant, junior grade (HC) U.S.N.

and

LAURA T. ANDERSON

For the past 19 years medical officers of the Navy have been required to submit to the Bureau of Medicine and Surgery reports of the number of doses of arsenicals administered and the reactions therefrom. This information has been compiled and published in the following issues of this BULLETIN:

September 1925.	October 1933.	October 1937.	January 1941.
January 1927.	October 1934.	January 1938.	October 1941.
January 1929.	January 1935.	October 1938.	January 1942.
July 1930.	October 1935.	January 1939.	October 1942.
October 1931.	January 1936.	October 1939.	January 1943.
October 1932.	October 1936.	January 1940.	November 1943.
April 1933.	January 1937.	October 1940.	January 1944.

In table 1 is shown the number of doses of each arsenical administered in the year 1943, together with the number and type of reactions, and similar data for the 19-year period, 1925 through 1943. It is noted that in 1943 there was 1 untoward reaction to every 5,111 doses administered and 1 death to every 245,331 doses. For the 19-year period there was 1 reaction to every 1,798 doses and 1 death to every 39,997 doses.

ARSENICAL DERMATITIS

Dermatitis in some form was included in 26, or 54 percent of the total reactions in 1943, as compared with 49 percent for 1942. The type of lesion was erythematous in 8 instances, eczematous in 2, exfoliative in 4, macular in 3, maculopapular in 4, purpuric

TABLE 1.—*Arsenicals, U. S. Navy, 1943 and 1925-43; type of drug, reaction, and ratio of doses to reactions*

	Number of doses administered	Reactions				Ratio of reactions to doses 1 to—	Ratio of deaths to doses 1 to—
		Mild	Severe	Fatal	Total		
Year 1943:							
Bismarsen	266	0	0	0	0	0	0
Mapharsen	227,796	13	16	0	29	7,855	0
Neorsphenamine	15,626	11	7	1	19	822	15,626
Sulfarsphenamine	32	0	0	0	0	0	0
Tryparsamide	1,611	0	0	0	0	0	0
Total	245,331	24	23	1	48	5,111	245,331
19-year period 1925-43:							
Acetarsones ²	1,013	1	0	0	1	1,013	0
Arsphenamine	41,558	27	14	1	42	989	41,558
Bismarsen ³	4,622	0	0	0	0	0	0
Mapharsen ⁴	625,476	66	39	11	106	5,901	625,476
Neorsphenamine	1,380,440	644	326	51	1,021	1,352	27,067
Silver arsphenamine ⁵	591	0	1	1	2	296	591
Sulfarsphenamine	30,935	17	8	0	25	1,237	0
Tryparsamide	75,215	3	1	0	4	18,804	0
Total	2,159,850	758	389	54	1,201	1,798	39,997

¹ Cerebral hemorrhage following the administration of mapharsen, 1942.² First administered during the year 1932.³ First administered during the year 1929.⁴ First administered during the year 1935.⁵ First administered during the year 1931.TABLE 2.—*Proportion of reactions of various types, 1929-43*

Classification	Number of reactions	Percent of total reactions
Arsenical dermatitis.....	379	39.32
Vasomotor phenomena.....	359	37.24
Liver damage.....	52	5.39
Blood dyscrasias.....	45	4.67
Reactions of minor importance.....	34	3.53
Table reaction.....	26	2.70
Jarisch-Herxheimer.....	26	2.70
Gastro-intestinal.....	20	2.07
Hemorrhagic encephalitis.....	10	1.04
Optic neuritis.....	3	0.31
Arsenical neuritis.....	3	0.31
Acute renal damage.....	3	0.31
Polynuritis.....	1	0.10
Borderline hemorrhagic encephalitis.....	1	0.10
Liver damage (doubtful reaction).....	1	0.10
Vascular damage (probable adrenal hemorrhage).....	1	0.10
Total.....	964	100.00

in 1, and urticarial in 4. The reactions were classified as 13 mild and 13 severe.

Mild reactions.—The thirteen mild reactions occurred after the following number of injections: Three after the third, five after the fourth, one after the sixth, two after the seventh, and one each after the eighth and thirty-second. The interval between the injection and appearance of symptoms varied from 30 minutes to 22 days. The length of time required for complete recovery varied from 1 to 17 days.

MAPHARSEN

Case 1-1943.—This patient was exposed to infection on 20 September 1943, and on 1 November he noted a chancre on the corona of the penis. The lesion was self-treated by iodine with a resulting burn. A darkfield examination on 5 November revealed *Treponema pallidum*.

Arsenical treatment was begun at once with a 0.02-gm. injection of mapharsen followed by a 0.03-gm. injection on 6 November and 0.06-gm. injections on 17 and 24 November. A Kahn blood test on 24 November was 2-plus.

Thirty minutes after each injection a rise in temperature was noted and the patient reported having a headache and general malaise. Pulse and respirations were normal. Physical examination disclosed nothing relevant to the case. Nausea was present within 3 to 4 hours after each injection except the first. The reaction temperature varied from 99.6° to 103.2° F., and lasted from 24 to 60 hours. Twenty-four hours after the fourth injection an urticarial rash appeared over both thighs and calves, and remained for 24 hours. The urine and blood findings were within normal limits. Treatment consisted of bed rest, the application of an ice cap for relief of the headache, and oral administration of $\frac{3}{8}$ grain of ephedrine sulfate. Recovery was complete in 2 days.

Case 2-1943.—This patient was infected on 8 May 1943. A diagnosis of syphilis was made because of positive findings on darkfield examination. Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 4 June, followed by a 0.04-gm. injection on 7 June and 0.06-gm. injections on 10 and 29 June. Twelve hours after the last injection the patient developed a toxic erythema over the entire body. No treatment was given, and the erythema disappeared in 24 hours.

Case 3-1943.—This patient was exposed to infection on 26 March 1943, and a diagnosis of syphilis was established by means of a darkfield examination which revealed *Treponema pallidum*. Arsenical treatment was begun with a 0.3-gm. injection of neoarsphenamine on 1 May, followed by a 0.45-gm. injection on 6 May and a 0.6-gm. injection on 11 May. The treatment was then changed to mapharsen, the patient receiving injections of 0.03 gm. on 20 May, 0.01 gm. on 14 July, 0.02 gm. on 19 July, and 0.03 gm. on 24 July.

Thirty hours after the last injection a macular and urticarial eruption appeared on the lower abdomen and over the inner surfaces of the arms and thighs. The erythrocyte count was 4,800,000, and the leukocyte count 11,000, with a normal differential count. No specific treatment was given and recovery was complete in 3 days.

Case 4-1943.—This patient was exposed to infection on 1 September 1942 and developed a penile chancre on 12 October. Darkfield examination showed *Treponema pallidum*. Kahn and Kolmer tests were positive.

From 15 October 1942 to 19 November 1943, the patient received 22 injections of mapharsen, a total of 1.26 gm. One-half hour after the last injection the patient noticed itching and a rash on the forearms and chest. Examination showed purpuric eruption over both arms and scattered on the chest. No desquamation was noted. He was given local treatment only and the rash disappeared in 4 days.

Two 0.03-gm. doses of mapharsen were given subsequently, and both produced the same reaction. Arsenical treatment was discontinued.

Case 5-1943.—After exposure to infection in March 1942, this patient developed a penile lesion, darkfield examination of which showed *Treponema pallidum*. From 7 April 1942 to 4 May 1943, he received 32 intermittent injections of mapharsen and 36 injections of bismuth as concurrent treatment. On 1 June 1943 he was admitted to the sick list complaining of a generalized dermatitis accompanied by a severe itching. The patient had been under antisymphilitic treatment for the past year but treatment had been discontinued 1 month prior to his admission. No other history was available.

Treatment consisted of sodium bicarbonate baths, administration of epinephrine, sodium thiosulfate intravenously, and dermal applications of calamine lotion. Recovery took place in 11 days.

Case 6-1943.—This patient was exposed to infection on 1 June 1943. A diagnosis of syphilis was established by darkfield examination of a penile chancre. A Kahn blood test made on 13 July was 2-plus. Arsenical treatment was begun with a 0.045-gm. injection of mapharsen on 2 July followed by 0.06-gm. injections on 4, 6, 8, 10, and 12 July.

After the fourth injection the patient had chills and fever lasting about 3 hours. Four hours after the fifth injection he again developed fever which lasted about 12 hours. Physical examination revealed a temperature of 103.4° F. and a diffuse, macular, erythematous rash on the chest and abdomen. The rash disappeared when the temperature became normal. Recovery occurred in 7 days, but antisymphilitic treatment was continued with bismuth subsalicylate for a period of 30 days.

Case 7-1943.—This patient noticed a "pimple" on the upper lip on 20 September 1943. He was on a ship without a medical officer, and the lesion was treated with silver nitrate. The lesion ulcerated and grew larger, and two weeks later glands on both sides of the neck began to swell and became tender. Darkfield examinations on 6, 11, and 19 October showed negative results. Kahn and Wassermann tests were repeatedly positive.

Antisymphilitic treatment was begun with 0.06-gm. injections of mapharsen on 20, 25, and 29 October. Nine days after the first injection the patient developed "the ninth-day erythema" which was characterized by chills, fever, and generalized maculopapular eruption. The skin lesions faded in a few days and the temperature quickly returned to normal.

NEOARSPHENAMINE

Case 8-1943.—After exposure to infection on 15 May 1943, this patient developed a penile lesion, and darkfield examination showed the *Treponema pallidum*. Arsenical treatment was begun with a 0.3-gm. injection of neoarsphenamine on 23 May, followed by 0.6-gm. injections on 25 and 27 May and on 8 June, a total of 2.1 gm.

Eight hours after the last injection the patient was admitted to the sick list with mild conjunctivitis, a slightly reddened pharynx, and a diffuse macular rash. The temperature was 102° F., and he complained of general malaise and severe generalized itching. Symptoms gradually subsided under treatment, and recovery was complete in 3 days.

Case 9-1943.—This patient developed a small penile lesion after exposure to infection early in January 1943. Darkfield examination showed *Treponema pallidum*, and arsenical treatment was begun with a 0.4-gm. injection of neo-

arsphenamine on 12 January, followed by 0.6-gm. injections on 14, 17, 18, and 19 January.

Five hours after the last injection the patient had chills and a temperature of 104° F. The following day the temperature dropped to 100° F., and a maculopapular rash appeared on the back, chest, abdomen, and upper extremities. He was given bed rest, phenobarbital, and abundant fluids, and recovered in 3 days.

Case 10-1943.—After exposure to infection on 15 May, 1943, this patient developed a penile lesion. A darkfield examination showed *Treponema pallidum*. A Kahn blood test was positive. From 6 July to 26 July he received 7 injections of mapharsen, a total of 0.39 gm. Eight hours after a 0.45-gm. injection of neoarsphenamine on 13 August a rash appeared involving the trunk, chest, abdomen, and extremities. Vesicles were present on both ankles. Complete blood count showed hemoglobin content 13 gm., 4,220,000 erythrocytes and 8,400 leukocytes with 4 band forms, 54 segmented cells, 34 lymphocytes and 8 eosinophils. The urine was normal. The icterus index was 4.

The patient was given supportive treatment which consisted of 10 injections of 10 cc. of calcium gluconate and liver extract, and recovery was complete in 17 days.

Case 11-1943.—This patient was admitted to the sick list on 20 August 1943, with a temperature of 100° F., and ulceration of the left tonsil. A smear showed organisms characteristic of Vincent's angina. He was treated with sodium perborate gargles and several applications of silver nitrate. He received 0.45-gm. injections of neoarsphenamine on 20, 21 and 22 August, and 4 days later his pulse became accelerated and a maculopapular eruption appeared on the skin overlying the trunk. The rash spread to the extremities but did not involve the face. Sodium thiosulfate, 1 gm., and liver extract, 10 units. were administered intravenously. The skin eruption disappeared in 4 days. Local treatment for Vincent's angina with sodium perborate was continued.

Case 12-1943.—This patient was infected on 31 December 1942, and an initial lesion appeared on the corona of the penis on 17 March 1943. A darkfield examination revealed *Treponema pallidum*. A Kahn blood test was positive. He was given 7 injections of neoarsphenamine, 0.4 gm. twice weekly, beginning on 17 March and ending on 17 April, a total of 2.8 gm. Three hours after the last injection the patient became nauseated but this passed, and 2 days later a diffuse erythematous rash appeared simultaneously over the entire body. Sodium thiosulfate, 10 cc., was administered the first evening and repeated the next day. Recovery ensued in 2 days.

Case 13-1943.—After exposure to infection on 15 August 1943, this patient noted a lesion on the dorsal side of the glans penis. Five darkfield examinations failed to reveal *Treponema pallidum*. However a Kahn blood test was 2-plus on 28 September and a repeat Kahn test was 4-plus on 5 October.

Antisymphilitic treatment was begun with a 0.9-gm. injection of neoarsphenamine on 5 October, followed by three 0.6-gm. injections (dates of injections not reported). Twenty-two hours after the last injection the patient complained of an itchy body-rash, chills, fever, and urticaria. The temperature was 103.6° F., pulse rate 112, and respirations 24. Treatment consisted of thiamine chloride, abundant fluids, liquid diet, and bed rest, and the patient returned to duty 7 days from the onset of symptoms with no apparent remaining ill effects from the toxic reaction.

Severe reactions.—The thirteen severe reactions occurred after the following number of injections: One after the third, three after the fourth, four after the sixth, and one each after the ninth, nineteenth, twenty-fourth, thirty-first, and thirty-second. The interval between the injection and appearance of symptoms varied from 1 hour to 9 days. The length of time required for recovery varied from 5 to 109 days. The recovery time was not reported in 3 instances.

MAPHARSEN

Case 14-1943.—After exposure to infection on 11 July 1943, this patient developed ulcers on the prepuce, one measuring 1.5 cm. and 3 ranging from 0.3 to 0.5 cm. in diameter. Several darkfield examinations and Kahn blood tests yielded negative findings. A Kahn blood test was positive on 17 August and doubtful on 20 August (the serum showed hemolysis). Kahn and Wassermann tests made on a specimen obtained on 18 August were reported positive. Typical maculopapular secondary syphilides developed on 23 August, and were treated by sulfonamides as chancroids prior to obtaining positive serologic evidence and before the development of secondary skin lesions.

Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 23 August and 4 hours later the patient developed a chill and a fever of 104.2° F. Prior to this a fever of 100° to 102° F. had persisted for 5 days. On 24 August the temperature was 99.8° F., and the patient felt much better, although he had a headache and sore throat. No open lesions were noted in the mouth and throat. Three injections of mapharsen were administered in 6 days, and the patient's temperature ranged between 101° and 103° F. daily. Physical examination showed evidence of secondary syphilis. Nausea, vomiting and a fever of 104.6° F. followed a 0.06-gm. injection of the drug on 30 August.

Urinalysis on 31 August showed numerous erythrocytes and leukocytes. A morbilliform rash, evident beneath the maculopapular syphilides, was probably the so-called "ninth-day erythema," although it appeared 8 days after the first injection of mapharsen. There was also generalized, shotty, non-tender adenopathy. Two days later the Frei test was negative in 24 hours and the morbilliform rash had faded. The patient was given 2 cc. of bismuth on 3 September, and on the following day he was improving, and the temperature was normal. The Frei test was negative at 48 and 72 hours.

Sensitivity tests were started on 7 September, neoarsphenamine being tested on the left arm and mapharsen on the right. When the 24-hour test patches were removed there was slight erythema on both arms, more noticeable on the left arm, and one vesicle on the left arm.

Test patches made on 9 September were negative to both mapharsen and neoarsphenamine. A 0.02-gm. injection of mapharsen was followed in about 4 hours by chill, nausea, vomiting, and a temperature rise to 102.8° F. Injection of the conjunctiva and an erythematous blush to the skin over the entire body were evident during the reaction. On the following day the temperature was again normal, and the patient felt well.

On 14 September a 0.1-gm. injection of neoarsphenamine was followed by fever of 99.4° F. for 2 days. Following consultation with a dermatologist, it was suggested that the arsenical be administered in small amounts of water, or if this proved ineffective, that intensive courses of water-soluble

bismuth (thio-bismol) be given. Accordingly, on 21 September mapharsen, 10 mg. in 0.3 cc. of water, was administered and following this injection, the maximum temperature was 99.4° F. On the following day all symptoms had disappeared. Recovery was complete in 31 days, but small graduated doses of mapharsen preceded by bismuth injections as tolerated were continued.

Case 15-1943.—This patient was exposed to infection in July 1942. There were no signs or symptoms of syphilis until he developed interstitial keratitis of the left eye on 26 February 1943. No other cause than syphilis was demonstrable. A Kahn blood test was 3-plus on 12 March and 4-plus on 16 and 30 March.

Treatment between 23 March and 2 April consisted of the local use of inductothermy to the left eye and four general fever therapy treatments ranging from 5 to 7 hours. On 23 March 2.0 gm. of tryparsamide were given at the height of fever. The pupil was kept dilated with atropine. No other antisyphilitic therapy was administered prior to the course of treatment during which the reaction occurred.

Arsenical treatment began with 0.06-gm. injections of mapharsen on 3, 5, and 8 April. The last injection was given with concurrent fever therapy of 7 hours. Since this reaction consisted of the erythema of Milan, the first dose of mapharsen was considered the cause of the reaction. The patient was thought to have scarlet fever because of the eruption and general malaise. Urinalysis showed mucus, occult blood 1-plus, 3 to 5 leukocytes and zero to 2 erythrocytes per high-dry field. The erythema disappeared and was followed by a fine exfoliation, not typical of scarlet fever. Recovery was complete in 5 days.

Case 16-1943.—This patient was exposed to infection on 12 September 1943, and 10 days later a lesion appeared on the corona of the penis. A darkfield examination was positive for *Treponema pallidum*.

From 24 September to 4 November 1943, he received two 0.9-gm. injections of neoarsphenamine, and seventeen 0.06-gm. injections of mapharsen. Two days after the last injection of neoarsphenamine given on 4 November, the patient developed a temperature of 99° F. His entire body surface was covered with erythematous papules varying in diameter between 1 mm. and 3 cm. with a marked tendency to confluency. The height of the erythema of skin was on 18 November when the temperature rose to 103.2° F. Thereafter the temperature gradually declined until 4 December, when it became normal. Exfoliation of the skin began on 20 November. Urinalyses showed 1-plus albumin on 9, 10, and 15 December, 4-plus on 20 December, and 3-plus on 22 December.

The patient was given daily starch solution baths, and 1 gm. of sodium thiosulfate intravenously twice daily for 4 days. The skin began to clear on 10 December, but the patient had albuminuria with moderate edema of ankles and feet. He was transferred to a Naval hospital in the continental United States for further treatment. No additional history of this case has been reported.

Case 17-1943.—Ten days after exposure to infection on 6 March 1942, this patient developed an indurated penile lesion. A darkfield examination showed *Treponema pallidum* and a Kahn blood test was 2-plus. From 31 March to 31 December, he received 24 injections of mapharsen, a total of 1.41 gm. Twenty-one injections of bismuth subsalicylate were given as concurrent treatment.

On the day following the last injection of mapharsen the patient was admitted to the sick list with an acute eczematous eruption which began on the left forearm and spread slowly to involve the skin of the arms, legs, face, and neck. This condition was not considered by the medical officer to be related to therapy. Itching was the only subjective symptom noted.

The patient was hospitalized on 5 February 1943, at which time the leg lesions were ecthymatous. A patch test with neoarsphenamine solution was strongly positive in 24 hours. Spinal fluid examination showed 2 cells, negative Kahn, no increase in globulin, and negative colloidal gold curve. Repeated blood counts showed a mild persistent eosinophilia.

The eruption improved slowly under the daily administration of 100 mg. of cevitic acid, 50 mg. thiamine chloride, and local application of bland ointments. Temporary cure was obtained on one occasion by the use of 4 gm. of sulfathiazole daily, but a relapse was only partially relieved by the same therapy. The leg eruption responded most slowly and finally cleared under the local use of 5-percent benzoic acid in a lecithinized alcohol-vaseline solution. There was complete recovery in 109 days.

Case 18-1943.—After exposure to infection on 15 October 1943, this patient developed a chancre located near the frenum and involving the corona and sulcus of the glans penis; there were multiple deep punched-out ulcers, and the inguinal glands were enlarged, tender, and painful. Kahn and Frei tests were positive.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 13 November and was followed by 0.06-gm. injections on 14, 16, 18, 20, and 25 November. One hour after the last injection the patient's temperature rose to 105° F. and erythema of the skin developed. This could possibly have resulted from contamination in the preparation of the individual dose. Others treated on the same day did not experience any toxic reaction. The patient had had a temperature of 99.2° F. for several days prior to this severe reaction and had been given 0.05 gm. of mapharsen on 13 December. On the following day there was some erythema of the skin but no elevation of temperature or other unfavorable symptoms. This was considered to indicate a sensitivity and the drug was discontinued.

Recovery occurred in 31 days. The general condition of the patient was excellent at the time of recovery, the temperature was normal and there was no diarrhea, dermatitis, or other subjective or objective symptoms. He was returned to duty with the recommendation that treatment for syphilis with bismuth subsalicylate be continued. The future use of arsenical compounds might be tried cautiously, or the use of penicillin be considered.

Case 19-1943.—The source of infection in this case is unknown. A diagnosis of syphilis, seropositive only, was made following a routine Kahn blood test on 16 February 1943. There was no history of syphilitic infection but the patient admitted repeated exposures. Arsenical treatment was instituted, beginning with a 0.03-gm. injection of mapharsen on 23 February, followed by 0.045 gm. on 26 February and 0.06 gm. on 2 and 9 March.

Two hours after the last injection the patient turned into his bunk because of a feeling of "light-headedness." Shortly thereafter he felt cold and began to shake. At that time he became conscious of frontal headache and generalized muscular aches, especially in the low-back region. He vomited several times and within the next 3 hours he had 3 loose watery stools. He claimed that he had had only one piece of toast and some coffee at breakfast, 2 hours before the mapharsen injection.

Four days later urticarial wheals appeared, which were temporarily alleviated by ephedrine and epinephrine. There was no previous history of allergy or any known sensitivity. Treatment for the reaction consisted in: (1) Acetylsalicylic acid, grains 10, and codeine, $\frac{1}{2}$ grain every 4 hours during the first 3 days; (2) ephedrine sulfate, $\frac{3}{8}$ grain at 1145 and 1245, and epinephrine, 5 mm. in 1:1,000 solution, at 1430 and 2120 on the same day; and (3) phenobarbital, $\frac{1}{2}$ grain orally, twice daily for 2 days. Symptoms gradually subsided under treatment and recovery was complete in 7 days.

Case 20—1943.—This patient was exposed to infection on 8 August 1941, and syphilis was diagnosed because of positive serologic tests, although physical and neurologic examination failed to reveal evidence of the disease. The patient said he had not noticed any sore on the genitalia, or in the mouth or throat, and denied having had a generalized rash or adenopathy at any time since exposure.

From 13 February 1942 to 21 January 1943, he received 30 injections of mapharsen, a total of 1.67 gm., and from 13 February 1942 to 11 March 1943, he received 33 injections of bismuth subsalicylate, a total of 4.12 gm.

The course of treatment during which the reaction occurred began with a 0.06-gm. injection of mapharsen on 11 March 1943, and $1\frac{1}{2}$ hours later the patient reported to sickbay complaining of nausea, vomiting, and a feverish feeling. His temperature was 102° F., pulse rate 90, and respirations 20. The temperature continued to rise until it reached a peak of 105° F. about 2 hours later. At the same time, a diffuse erythematous rash with small urticarial wheals appeared on the extremities. He was extremely restless and complained of severe generalized itching. Some relief was obtained by the administration of morphine and sodium amytal. Urinalysis showed albumin 4-plus with numerous fine and coarse granular casts, and numerous erythrocytes.

Late in the afternoon 0.5 gm. of sodium thiosulfate was given intravenously in the hope of aborting a possible developing arsenical dermatitis. The following morning the patient's temperature had dropped to 99.2° F. and his general appearance was much improved. The erythematous rash had faded considerably. Thereafter improvement was rapid and the patient was symptom-free within 3 days, although the albumin and casts in the urine did not disappear for 10 days.

Comment.—The exact nature of the reaction in this case is difficult to evaluate for the following reasons:

1. During the week preceding the reaction the patient had suffered from an attack of catarrhal fever, acute, and had been discharged from the sick list on the same morning that the injection of mapharsen was given.

2. For several months the patient had had an eczematous type of dermatitis on both ankles, which he stated "always appeared in the tropics and disappeared when in a temperate climate." However, it was felt that this did not constitute evidence of an unfavorable response to mapharsen, as the dermatitis had first appeared more than a year before antisyphilitic treatment was instituted.

3. Sixteen days after this reaction, although no further treatment had been given, the patient was again admitted to the sick list with a chill and temperature of 104° F. Since then he had 3 more chills at intervals of approximately 48 hours, with a rise in temperature each time to 104° or 105° F., followed by a rapid drop to normal. His appearance during these attacks was

similar to that at the time of the mapharsen reaction, with the exception of the erythema and urticarial wheals noted at the time of reaction.

Repeated blood smears obtained at the beginning of each chill were negative for malarial parasites. Nevertheless, as this patient was on temporary detached duty ashore in a malarial infested region for one week, about 4 weeks prior to admission, it is felt that the present illness may be malaria. It is not impossible that the original chill following the injection of mapharsen might have been due to the same cause, and its relation to the mapharsen no more than coincidental. Without establishment of a definite diagnosis of malaria, however, the present diagnosis must be reported as an arsenical reaction.

Case 21-1943.—After exposure to infection on 22 May 1941, with no apparent initial lesion, this patient developed, on 27 June, a generalized lymphatic enlargement and a maculopapular rash on the face, chest, arms, and palms of the hands typical of secondary syphilis. The glans penis and the foreskin were moderately swollen and red. A Kahn blood test was 4-plus. It was supposed that the chancre was urethral in type.

From 27 June to 29 July, the patient received 7 injections of mapharsen, a total of 0.3 gm., and from 15 August 1941 to 24 July 1942, he received 23 injections, a total of 1.35 gm. From 28 October 1942 to 8 January 1943, a concentrated routine treatment was employed, which included 2 intravenous injections of mapharsen and 1 intramuscular injection of thio-bismol each week. Because of the gradual appearance of this reaction it is not possible to place the blame on one particular dose. The first symptoms appeared two or three weeks after the last dose of mapharsen.

The clinical manifestations consisted of two small eczematoid lesions on the external malleolus of each foot. Some itching was present. About one month after the last dose, the small eczematoid lesions began to spread very rapidly and assumed a raw, weeping, infected appearance. The patient was hospitalized and treated with hot permanganate soaks. The weeping, infected characteristics of the lesions responded rapidly, but a dry, scaling, and discolored eczematoid rash remained.

Scratch tests made on the arm on 11 March showed no reaction to thio-bismol powder, but produced around the site of the scratch a lesion identical in every respect to those on the patient's legs when mapharsen was used.

Laboratory findings were negative, and the patient was returned to duty on 12 March 1943.

Since insufficient antisyphilitic treatment had been given for a permanent cure, the possibility of substituting neoarsphenamine for mapharsen was considered. However, a skin test revealed the patient to be equally sensitive to that drug. Regardless of the slight allergic response, it is believed that mapharsen should be continued, either in diminished doses, or in regular amounts at longer intervals, until he is well.

NEOARSPHENAMINE

Case 22-1943.—One month after this patient's exposure to infection on 2 February 1943 an initial penile lesion appeared which was associated with bilateral, firm, nontender inguinal lymph nodes. Darkfield examinations did not show the *Treponema pallidum*, and the diagnosis of syphilis was established by 4-plus Kahn blood tests. Arsenical treatment was instituted with 0.6-gm. injections of neoarsphenamine on 28 March and on 1, 5, 8, 12, and 15

April. On 22 and 26 April bismuth subsalicylate, 0.2 gm., was given intramuscularly without untoward reaction.

Three days after the last injection of neoarsphenamine the patient complained of an itching skin eruption, aching eyes, and general malaise. The eruption consisted of a fine vesiculopapular rash distributed over the entire body. The lips were dry and cracked, but the temperature was normal. The buccal mucosa was reddened but no vesicles or ulcerations were found. White blood cell count and urinalysis were within normal limits.

Treatment consisted of bed rest; abundant fluids; sodium phosphate in 25-percent solution, 8 cc. three times daily; and intravenous 10-percent dextrose in saline solution, 1,000 cc. on admission. Zinc oxide lotion with 1-percent phenol and $\frac{1}{4}$ -percent menthol was applied locally. The patient was free of subjective symptoms within 12 hours. The dermatitis involuted promptly and superficial grainy peeling was complete by 29 April, 11 days after onset of the toxic reaction.

Case 23-1943.—This patient denied exposure to infection. He reported to sickbay on 6 October 1943, with a 2-mm. crusted pustule on the shaft of the penis. Facilities were not available for a darkfield examination. A Kahn blood test was negative on 14 October and strongly positive on 4 and 9 November. A darkfield examination on 9 November did not show treponemas and diagnosis was made on the two positive Kahn tests. There was no record of recent immunizing shots or malaria.

A 0.4-gm. injection of neoarsphenamine on 9 November was followed by 0.6-gm. injections on 10, 11, 12, 13, and 14 November. On the following day the patient complained of anorexia of 3 days, and malaise of 12 hours. Arsenical therapy was withheld, and 12 hours later there was prominent edema of the face and arms together with a maculopapular, confluent skin rash on both sides of the trunk and upper extremities. The temperature was 101.2° F. Since the patient had no chills, itching, scaling, eczema, jaundice, petechiae, or headache, it was felt that this might be an example of "ninth-day erythema." The day following the appearance of the rash, the areas first involved became solidly erythematous, while the uninvolved lower extremities began to assume the maculopapular rash, mostly on the extensor surfaces. The edema of the face had almost completely disappeared. The rash was considerably diminished on the second day, and the patient felt much better. Recovery was complete in 40 days.

On the fifth day after the appearance of the initial rash it was decided to determine by a therapeutic test whether this had been an arsenical reaction or the ninth-day fever. A 0.3-gm. dose of neoarsphenamine in 10 cc. of distilled water was administered very slowly. Ten minutes later the patient developed a typical nitritoid reaction of moderate character, together with a marked itching of the skin and some urticaria.

Case 24-1943.—After exposure to infection on 1 May 1943, this patient developed a penile lesion, a darkfield examination of which revealed *Treponema pallidum*. Arsenical treatment was begun with a 0.3-gm. injection of neoarsphenamine on 17 May, followed by a 0.3-gm. injection on 18 May, a 0.45-gm. injection on 20 May, and a 0.6-gm. injection on 22 May.

Eight hours after the last injection, the patient had a temperature of 103° F. The urine was 4-plus positive for albumin. Examination of the blood disclosed no abnormalities.

One gram of sodium thiosulfate was administered intravenously daily for 3 days. No further history of this case is available.

Case 25-1943.—This patient, a supernumerary, was exposed to infection on 20 December 1942, and 4 days later a penile lesion appeared, positive on darkfield examination for *Treponema pallidum*. No blood test was made. A 0.3-gm. injection of neoarsphenamine on 31 December was followed by injection of 0.6 gm. on 6 January, 0.45 gm. on 14 January, and 0.6 gm. on 21 and 27 January and 2 February. Five 1.5 cc. intramuscular injections of bismuth subsalicylate were given between 31 December 1942 and 28 February 1943.

Four days after the last injection of neoarsphenamine scaling of the skin on the face, around the ears, and in the axilla was noted, and later moderate exfoliation of the skin on the arms and legs. Two weeks later the patient was seen to have numerous excoriations and superficial eczematoid lesions on the arms and legs. This condition was treated with hot baths and sulfathiazole ointment, and recovery occurred in 28 days.

Case 26-1943.—Two weeks after this patient was exposed to infection on 10 September 1943, a primary penile lesion and inguinal adenopathy developed. A Kahn blood test was 4-plus. Antisiphilic treatment began with a 0.03-gm. injection of mapharsen, followed by eight 0.6-gm. injections of neoarsphenamine between 26 October and 27 November.

When the patient appeared for his next treatment on 1 December he complained of very slight generalized itching of the skin but there were no visible dermatologic manifestations. No treatment was given, and 2 days later a slight generalized erythema appeared and itching continued. Both symptoms gradually became worse, and on 11 December the patient was transferred to a station hospital. A week later there was generalized exfoliation of the skin, the temperature varied between 99.6° and 103.6° F., there was urinary retention, and blood chemistry showed reduced total proteins and reversal of the albumin-globulin ratio. Five days later there was marked edema, and multiple skin abscesses.

Blood culture on 24 December was positive for pneumococcus. On 4 January 1944 there was evidence of incipient agranulocytosis. Six days later the general condition was unchanged, and the temperature ranged from 101° to 104° F. The patient was transferred to a Naval hospital for further observation and treatment.

Treatment for the reaction consisted of sodium thiosulfate intravenously; calcium gluconate orally; dextrose intravenously; sulfathiazole; penicillin; whole blood transfusions, and blood plasma.

The hospital to which the patient was transferred on 11 January reported that on admission in a semicomatose condition, the patient was given transfusions of whole blood plasma. On the twelfth day after admission his temperature returned to normal. The leukocyte count was 21,300. A small ulcer appeared on the cornea of the right eye. On 6 March desquamation of the skin was continuing and the corneal ulcer was reported as healing. The patient was ambulatory and gaining weight.

COMMENT

In 1943, medical officers of the Navy administered a total of 245,331 doses of arsenicals and reported the occurrence of 48 untoward reactions. Of these toxic reactions there were 26 cases of arsenical dermatitis, a ratio of one to every 9,436 doses. Of interest in connection with a review of the causes of arsenical

dermatitis are the instances in which premonitory signs were noted. They tend to indicate the necessity for careful examination and questioning of each patient before administering an arsenical.

For example, in case 18 an erythematous rash and severe febrile response followed the fifth injection of mapharsen. It was believed that this could have resulted from contamination in the preparation of the individual dose. Eighteen days later, however, a sixth injection of mapharsen was followed by some erythema but no elevation of temperature. This was considered a manifestation of sensitivity to the drug and its use was discontinued. In case 21, 3 months after 30 injections of mapharsen had been given, a concentrated routine treatment with mapharsen was employed. The first signs of a reaction appeared from 2 to 3 weeks after the last injection. Because of gradual appearance of this reaction, it was deemed impossible to place the blame on one particular dose. In case 23 a maculopapular rash followed the sixth injection of neoarsphenamine, and a typical nitritoid reaction developed 10 minutes after a seventh injection given 5 days later.



CANNED FRUITS AND VEGETABLES

The energy, carbohydrate, protein, and fats derived from canned fruits and vegetables may be considered as being of slight nutritional significance. The chief nutritive values of these foods are associated with the vitamins and minerals they contain. Canned citrus fruits and tomato products are among the more valuable dietary sources of ascorbic acid. The provitamins A contained in canned leafy green and yellow vegetables constitute a major source of vitamin A activity in our diets. More concentrated food sources of the B vitamins and minerals are not found among the fruits and vegetables either fresh or canned. However, many canned fruits and vegetables contain important quantities of niacin, thiamin, riboflavin, calcium, phosphorus, and iron, nutrients which many diets supply in suboptimal quantities.—FEASTER, J. F.: Nutritive values of canned fruits and vegetables. *Am. J. Pub. Health* 34: 593-597, June 1944.

TSUTSUGAMUSHI DISEASE*

DONALD S. FARNER

Lieutenant, junior grade H-V(S) U.S.N.R.
and

CHRIS P. KATSAMPES

Lieutenant, junior grade (MC) U.S.N.R.

Tsutsugamushi disease has been known and investigated under several names in various Asiatic and Australasian areas for several decades. In general, however, the extensive investigations and the literature in which they are recorded have not been subjected to a comprehensive study in this country. With the opening of the Pacific and Asiatic theaters of war, tsutsugamushi disease has become a disease of military and naval importance.

The widespread distribution of the disease, its clinical variability, and the semi-isolation of various groups of investigators have led to considerable confusion in terminology. It is the purpose of this paper to summarize the literature on tsutsugamushi disease in such a manner as to clarify in so far as is possible some of this confusion in terminology, and to show briefly the research and observations which have been recorded in the various areas. A further object is to indicate, on the basis of published records, the distribution of the disease as it is known at the present time.

In recent years it has become apparent that many of the typhus-like fevers of these regions are in reality tsutsugamushi disease, or very closely allied to it. The investigations of Lewthwaite and Savor (101) (102) and Kouwenaar and Wolff (84) have shown clearly the identity of tsutsugamushi disease and "rural" and "scrub" typhus. Their conclusions were based not only on clinical and epidemiologic similarities, but also on serologic tests and cross-immunity reactions in animals. Savor and Lewthwaite advocated that the terms "scrub" typhus and "rural" typhus be discarded in favor of the prior name, tsutsugamushi disease. Heaslip (56) and Burnet (10) have concluded that the variously termed North Queensland fevers are likewise tsutsugamushi disease.

Tsutsugamushi disease may be defined as one of the typhus group of diseases caused by *Rickettsiae tsutsugamushi*, transmitted to man by the bite of a larval trombiculid mite. It is charac-

* Attention is invited to the article on "Scrub Typhus" by Captain Joseph B. Logue on page 645.

terized clinically by an abrupt onset with fever and severe headache which may or may not be preceded by the development of a primary skin lesion at the site of the bite, and a tender regional lymphadenopathy; by the appearance of a maculopapular rash on the fourth or fifth day after onset of symptoms; and by a febrile course terminating by crisis or slow lysis after 2-week duration. The exact incubation period has not been determined; estimates vary from 9 to 21 days. It is characterized epidemiologically by being associated chiefly with plantation, scrub, or jungle grasses in rural areas. It is distinguished serologically, except in rare instances, by the development of the Weil-Felix OX-K agglutinins in the second week of the disease.

Briefly, it must also be mentioned that the disease varies greatly in severity in each geographic region, but over a period of years the highest mortality has occurred in Japan whereas the disease is uniformly mild with a low case fatality in the Pescadores. Outbreaks of greater severity than usual have been recorded occasionally in Australia, Malaya, New Guinea, and other regions. No adequate explanation has yet been offered for these variations in severity.

Cerebral symptoms of delirium or marked apathy, a dry cough with a variable degree of an atypical pneumonia, diminution in auditory acuity, and photophobia with a "peculiar" mild suffusion of the eyes are frequent clinical findings. The fever often reaches 105° F. and may be of a remitting character. Usually there is an associated relatively slow pulse rate and moderately lowered blood pressure. Cyanosis, with or without evidence of acute circulatory collapse or cardiac failure from a rickettsial myocarditis, may develop. The last is of serious prognostic importance, foreshadowing death or a lengthy convalescence. In malarious areas, the moderate splenomegaly becomes more apparent during convalescence by a decrease in size.

The clinical diagnosis is greatly aided by the presence of a typical primary lesion. The entire body must be carefully searched since it occurs on any part of the body. Typically, the fully developed lesion consists of a black center or eschar surrounded by a pink areola. When the lesion is found in moist regions of the body the black scab may be absent, revealing a round shallow gray ulcer, 2 to 10 mm. in diameter. The initial lesion, if it occurs, may progress only to a papular stage which is difficult to recognize. Rarely more than one primary lesion is present. The Japanese invariably find the primary ulcer or eschar in their cases. In Sumatra, about half and in Malaya and Australia one-tenth or less of the cases observed were noted to

have a primary lesion. Several factors have been suggested to account for the wide difference in the reported incidence of the primary lesion. It is easy to overlook, especially in the early stages of development and in the presence of skin lesions due to other causes. Since Lewthwaite and others, as well as Kouwenaar and Wolff, have shown experimentally in monkeys that the rickettsia injected intradermally produced a typical eschar, but did not when introduced subcutaneously, it is conceivable that the feeding habits of the vector involved and the thickness of the epidermis may determine the incidence of the primary lesion.

Except for the striking differences in mortality and incidence of the primary lesion, the clinical picture as described in the literature is apparently quite constant throughout the geographic distribution of the disease.

Serologically, the OX-K agglutinins often rise to titers of 1 : 2,000 or higher. A definitely increasing or falling titer or a single positive determination in a dilution of 1 : 125 is considered diagnostically significant when the test is properly performed and controlled. In the absence of OX-K agglutination, cases without an initial lesion are difficult to diagnose as tsutsugamushi disease. At the present time, high OX-K agglutinin titers have been found only in tsutsugamushi disease. Rickettsia, however, have been isolated from cases, usually severe, which developed no OX-K agglutinins.

The same basic micropathology of vasculitis and perivasculitis has been described in postmortem material from Japan, Malaya, New Guinea, Formosa, and Australia.

HISTORY

Tsutsugamushi disease was apparently well known in ancient times in China. Li Shih-chên (103) cites the description of Kêh-Hung in his *Choo-hô-fang* (3d Century, A. D.) which not only gives an accurate account of the clinical symptoms but also attributes the disease to the bite of the *sha-shi*. Since *sha-shi* is described as a minute red insect it is plausible to assume that the reference is to a trombiculid larva. In modern times the first accounts of the disease were those of Palm (140), a medical missionary, in 1878, in a letter to the Edinburgh Medical Society, and Baelz and Kawakami (6) one year later. Palm as well as Baelz and Kawakami state that the disease had been known to the Japanese physicians on Honshu for many years. Both accounts indicated at this early date that the disease was almost absolutely restricted to the flood plains of the Omono, Mogami, and Shinano Rivers of Honshu. Both articles cite, furthermore,

the firm belief of the natives that the disease was caused by the bite of *akamushi*, a trombiculid larva. However, later Baelz rejected this in favor of a miasmatic theory involving a toxic substance from hemp.

Although Baelz discredited the *akamushi*-transmission theory it was revived on the basis of epidemiologic observations by Kitasato¹ and Tanaka² (162) (163). The latter investigator has, however, persistently advocated that the disease is due to a toxic substance or enzyme elaborated by the salivary glands of the larval mite, *akamushi*. Even as late as 1933 Tanaka (164) reaffirmed his belief in this theory. By 1920 the experiments of Kitashima and Miyajima (75) (76), Nagayo et al. (121) and Kawamura (61) firmly established the transmission of *tsutsugamushi* disease by *Trombicula akamushi* Brumpt. As early as 1901 Hayashi presented evidence that *tsutsugamushi* disease was also, if not primarily, a disease of wild rodents in the endemic areas and that these animals were the natural reservoirs. Later (46) (47) (48) he demonstrated the same to be true for certain species of terrestrial birds. In 1915-16 Nagayo et al. (119), Kawamura (61), and Miyajima and Okumura (111) independently described the life cycle of *Trombicula akamushi*. By 1932 the experiments of Hayashi, N. Ogata et al., Nagayo et al., and Nishibe et al. had clearly established the rickettsial etiology of the disease. Following this the volume of research on *tsutsugamushi* disease has distinctly decreased. Attention has been turned primarily to diagnostic tests and prophylactic measures. In 1931 Felix and Rhodes (24) in England demonstrated that *tsutsugamushi* disease was a member of the OX-K group of typhus diseases. This was confirmed by Kawamura et al. (62) (63). Kuroda (86) in 1936 described a successful skin test with a proteus OX-K antigen. Hayashi (44) (47) (48) has used a vaccine composed of living avian strains of *Rickettsia tsutsugamushi*. Kawamura et al. (64) (68) (73) have reported the use of the living mild Pescadores strain prophylactically. Hayashi and Kato (54) and Kato et al. (59) have described a vaccine prepared from infected lymph glands and spleens.

According to Hatori (40) *tsutsugamushi* disease was first recognized in Formosa in 1908. By 1919 sufficient investigations and observations had been made to allow Hatori to describe its epidemiology accurately. It was noted to be seasonal with the

¹ Although many authors credit Kitasato with the revival of the mite-transmission theory, no citations to publication are given.

² Apparently Tanaka first endorsed the mite-transmission theory in his series of articles dealing with the etiology of *tsutsugamushi* disease: *Erster Bericht ueber das Grundswesen der Japanischen Ueberschwemmungsfeber*. *Ztschr. Tokio Med. Gesellsch.* 6 (21): 35-36; (22): 53-56; (23): 17-21.

largest number of cases from October to November and that the case fatality was about 10 percent as compared with 30 to 50 percent in Japan at that time. Based on the investigations in Japan as well as his own work with experimental infections, he decided that the vector in Formosa was also *Trombicula akamushi*. The endemic areas were described as river valleys, fertile plains, and woodlands, either at the bases of mountains or on elevated plains. In 1921 Kawamura and Yamaguchi (72) compared in detail the tsutsugamushi disease of Japan and Formosa. It was concluded that the etiology was the same although a milder strain of the organism was thought to occur in Formosa. In 1930 Matsumoto (108) pointed out that tsutsugamushi disease could be contracted at altitudes as high as 5,000 feet in central Formosa. Morishita (114) (115) (116) (117) on the basis of extensive studies (1923-1938) has been able to point out that there is no difference in the susceptibility of Chinese and Japanese although the aborigines are far less susceptible, perhaps indicating a natural immunity. His data placed the case fatality at 12 percent. This author has also isolated a strain of rickettsia similar to the Japanese strains although less virulent and with a slightly different reaction in laboratory animals. It is of interest to note that both Morishita (117) and Kawahigasi (60) report a number of cases without the primary lesion. These are referred to as *atypical tsutsugamushi* and have apparently not been confused with endemic murine typhus as *tropical typhus*, as such cases have been confused in the Netherlands Indies and Malaya.

Tsutsugamushi disease was first reported from the Pescadores (Boko) Islands by Yamamiya (195) in 1935. It appears probable that the disease has existed there for many years but has been overlooked because of its milder course. Kawamura and Yamamiya (73) reported the demonstration of rickettsia from several cases and characterized them as similar to the Japanese strains but less virulent. Also they reported the presence of *Trombicula akamushi* parasitizing rodents, dogs, and the domestic fowl. Positive Weil-Felix agglutination with the OX-K antigen developed in all cases and the primary lesion was invariably present. These authors emphasize that the Pescadores are dry and seemingly unfavorable to the development of *Trombicula akamushi*. This peculiar situation was also emphasized by Morishita (117) whose statistics indicate a cyclic occurrence of the disease with the peak in June and July. He places the case mortality at 5.6 percent. Because of the mild nature of the Pescadores strain Kawamura and Ueda (70) have employed it in the treatment of general paresis and Kawamura et al. (64) (68)

have used it as a prophylactic inoculation against the more severe tsutsugamushi disease of Japan.

Tsutsugamushi disease was first observed in the Netherlands Indies at Deli in Sumatra as early as 1902. The first description was published in 1910 by Schüffner and Wachsmuth (152) (153), who called the disease *pseudotyphoid fever* of Deli.³ The disease was described as resembling typhoid fever but distinguishable from it by the negative bacteriologic analysis and the presence in some cases of a primary lesion. It was noted further that the disease was contracted only by men working in the brush and jungle grass and that it was similar to the tsutsugamushi disease of Japan although the case fatality was lower. On the basis of the Japanese investigations Schüffner and Wachsmuth suggested the possibility of the mite-transmission of their pseudotyphoid fever. It was also noted that the disease was nonseasonal. In 1915 Schüffner (150) gave statistics showing the case fatality to be 3 percent; 39 percent of the cases showed the primary lesion. It is of considerable interest to note that Schüffner diagnosed all cases, with or without primary lesion, as pseudotyphoid fever. Subsequent investigators incorrectly separated those without primary eschars and diagnosed them with cases of endemic murine typhus as *tropical typhus*.

In 1924 Walch (174) (175) (176) (177) and Walch and Keukenschrijver (179) (180) cited experiments, observations, and epidemiologic data implicating *Trombicula deliensis* Walch as the vector of pseudotyphoid fever in Sumatra. These authors recognized only those cases with primary lesion as pseudotyphoid, thus starting the confusion in nomenclature that prevailed in the literature for the ensuing 15 years. For some time two diseases of the typhus group were recognized, i.e., *tropical typhus* (without primary lesion) and *pseudotyphoid* or more commonly *mite fever* (with primary lesion). With the advent of the use of the Weil-Felix agglutination reaction it became evident that *tropical typhus* cases fell into two serologically distinct groups, OX-K positive (called *scrub* or *rural typhus*) and OX-19 positive (called *urban* or *shop typhus*). Wolff (185) (186), who first used the Weil-Felix agglutination with OX-K antigen in 1929 with scrub typhus and mite fever, suggested the possibility that mite fever (OX-K positive with primary lesion) and scrub typhus (OX-K positive without primary lesion) were the same or similar diseases.

³ English and American authors frequently refer to Schüffner's term as *pseudotyphus*. However, the original description was written in German in which "Pseudotyphus" would actually mean "pseudotyphoid fever." This is further supported by the fact that in the original description it was compared to typhoid fever and not to typhus and further by the fact that in subsequent papers in English Schüffner spoke of the disease as "pseudotyphoid fever of Deli."

However, the term "tropical typhus" continued to be used loosely in the Netherlands Indies literature until 1941 or later as a designation for tsutsugamushi disease without eschar, or endemic murine typhus or both. A series of investigations with laboratory animals by Kouwenaar and Wolff (80) (81) (83) (190) (191) (192) (193) supported by epidemiologic observations finally led these authors to conclude in 1936 (84) that scrub typhus (OX-K group of tropical typhus) and mite fever were the same and that this disease was closely allied to tsutsugamushi disease of Japan although somewhat milder in nature. Kouwenaar (78) regarded the Sumatran disease as identical with the tsutsugamushi disease of Malaya and concluded that there were in the Netherlands Indies two diseases of the typhus group mite typhus (tsutsugamushi disease) and shop or urban typhus (endemic murine typhus). In 1939 Kouwenaar and Wolff (85) provisionally named the etiologic organism *Rickettsia sumatranus* and concluded that it was similar to the Serangayee strain of Malaya, but slightly different and milder than the Japanese strains. In 1941 Gispén (32) showed that the rickettsiae could be cultured in duck eggs more readily than in chicken eggs.

In Malaya the history of tsutsugamushi disease investigation closely parallels that in Sumatra. Dowden (20) in 1915 reported a suspected case of kedani river fever (tsutsugamushi disease) but the reasons for considering it as such are quite obscure. In 1925, Fletcher and Lesslar described *tropical typhus* which is now recognized to have included two types of typhus, namely endemic murine and tsutsugamushi disease without primary lesion (scrub typhus). For a time, from 1926 to 1934, the cases of tropical typhus in Malaya were classified as follows: (1) The *shop, urban* or "*W*" type occurring in city people and showing a positive OX-19 or Warsaw strain agglutination with their sera; (2) the *rural, scrub* or "*K*" type occurring in rural inhabitants, developing no primary lesion or eschar and showing a positive OX-K Weil-Felix type agglutination; and (3) *tsutsugamushi disease* identical with the scrub type except for the presence of the primary lesion, ulcer or eschar. However, Lewthwaite and Savor (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) proved the identity or very close relationship of the scrub or "*K*" type and tsutsugamushi disease on clinical, epidemiologic, etiologic, and serologic grounds, including cross-immunity tests in laboratory animals. Gater (31) in 1930 presented epidemiologic and other observations implicating *Trombicula akamushi* and *Trombicula deliensis* as the vectors. Anigstein (3) at the same time reported tests which he believed indicated rats including *Rattus rattus diardii* as the reservoir

hosts. This investigator has also accepted the conclusion of Lewthwaite and Savor that tsutsugamushi disease and scrub typhus are identical.

Although investigations have been less extensive in French Indo-China the story is similar to the history of the disease in Malaya and Sumatra. It is possible that some of the cases described in 1908 by Yersin and Vassal (196) (197) as a "disease resembling typhus," contracted by laborers working on the construction of a railroad embankment, may have been tsutsugamushi disease. However, the descriptions do not allow a definite conclusion. In 1915 Noc and Gautron (131) reported two cases of a "fever of unknown etiology resembling pseudotyphoid of Delhi" which have been generally regarded as tsutsugamushi disease. The presence of tsutsugamushi disease in Indo-China was definitely established by the observations of LaGrange (88) who in 1923 observed a case with primary lesions which ran the typical course of tsutsugamushi disease. There was a period (1925-1935, approximately) when tsutsugamushi disease cases without primary lesions were included with endemic murine typhus as *tropical typhus* (typhus tropical). Those with the primary lesion were called tsutsugamushi disease or "*fièvre fluviale de Japon*." In 1931 Vielle and Souhard (171) demonstrated the similarity of the etiologic organism in Indo-China to that of tsutsumagushi disease of Japan, although in some respects the strain from Indo-China was more similar to the Sumatran strain.

This was confirmed in 1938 by Delbove and Nguyen-van-huong (16) who suggested that tsutsugamushi disease of Indo-China, however, was intermediate between the tsutsugamushi disease of Japan and the Sao Paulo-Rocky Mountain spotted fever group. Ragiot et al. (143) were of the same opinion. Montel (113) related the tsutsugamushi of Indo-China to the mite fever (tsutsumagushi with primary legion) of Sumatra. After 1932 it became obvious that there were two types of tropical typhus, *scrub typhus* (typhus broussailles) which was OX-K positive and *endemic murine typhus* (typhus murin) which was OX-19 positive. After this differentiation was made, the similarities of scrub typhus and tsutsugamushi disease became more obvious. Ragiot and Delbove (146) in 1939 pointed out that four strains of scrub typhus rickettsia and one of tsutsugamushi disease rickettsia had been isolated and studied and that there could be no further doubt of the etiologic identity of the two diseases. They concluded further that a greater tendency for the formation of the primary lesion exists among Europeans than among natives. Vaucel and Bruneau (167) isolated from OX-K positive rats in Hanoi an OX-K proteus bacillus strain.

In Australia, Smithson (157) in 1910 first described "*Mossman fever*" which in some of its clinical and epidemiologic characteristics as described resembled tsutsugamushi disease. He felt that the disease first made its appearance, soon after the settlement of the North Queensland Area in 1877, among settlers working in the timber. Clarke (13) gave a more elaborate clinical description of the disease entity called Mossman fever. Breinl, Priestly, and Fielding (9) in 1914, impressed by the regional glandular enlargement, called their cases of coastal fever, *Mossman fever* and pseudotyphus of sugar cane cutters, *endemic glandular fever*. Cilento (12) in 1923 indicated several similarities between some of the Queensland fevers and tsutsugamushi disease. Wheatland (183) in addition to reporting again Clarke's records of 1,482 cases with a case fatality of less than one percent, reported an outbreak of so-called "*Sarina fever*" with a mortality of 20 to 30 percent. He also noted that the prevalence of scrub itch bore no relation to the incidence of fever cases. None of these authors mentioned primary lesions, although all of them expressed the idea of insect transmission.

The etiology of one group of the Queensland fevers became clearer when Langan and Mathew (89), Unwin (166) in 1935 and Mathew (107) correlated clinical and epidemiologic findings with positive OX-K agglutinations. These authors were also the first to observe primary lesions although they were found only in a small number of cases. A new rather unfortunate term, *endemic tropical typhus*, was introduced. Mathew (107) first isolated rickettsiae from a fatal case. Finally, Heaslip (56) in 1941 concluded that his 54 cases were tsutsugamushi disease on the basis of clinical and epidemiologic observations. He failed, however, to perform cross-immunity tests of rickettsiae isolated from his cases with known tsutsugamushi strains. It does seem very likely, however, that many, if not all, of the cases of coastal fever, Mossman fever, endemic glandular fever, pseudotyphus of sugar cane cutters, and endemic tropical typhus are actually tsutsugamushi disease or caused by a closely related strain of rickettsiae.

Heaslip (56) in 1941 found a number of species of mammals to be OX-K positive but was able to demonstrate rickettsiae in but a single specimen of *Rattus conatus*. On epidemiologic grounds he suggested *Trombicula deliensis* Walch as the vector.

Tsutsugamushi disease was probably first observed in the New Guinea area in 1930 at Rabaul, New Britain, by Sinclair (155) although it is not entirely certain that the case observed by him was actually tsutsugamushi disease since he did not perform an OX-K agglutination. In 1935 Gunther (33) recorded two

OX-K positive cases in the Morobe area of New Guinea and cited the "mite-transmission hypothesis." In 1937 (34) he related the disease to tsutsugamushi disease and scrub typhus on the basis of serology. In the same year von der Borch (172) described a series of 14 cases observed by him in the gold fields at Wau, New Guinea. In 1938 Gunther (35) reported studies on the trombiculid larvae of the Morobe district of New Guinea. He suggested *Trombicula hirsti* Sambon as the vector.⁴ In 1939 Gunther and Schroeder described further cases, noted that the disease was confined to whites and placed the case fatality at 20 percent. Gunther (38) (39) indicated the bandicoot, *Echimi-pera cockerelli* Ramsay, as a possible reservoir host.

The typhus picture in India has been a confused one until recently when some clarification of the problem has become apparent. It was not until 1932 that the possible existence of tsutsugamushi disease was indicated. Christian (11) in that year described a case of typhus-like fever with an OX-K positive agglutination following a tick bite 10 to 12 days previously and with regional glandular enlargement. Guinea pigs inoculated with patient's blood developed OX-K agglutinins. No eschar was noted. MacNamara (104), Boyd⁵ and then others (Covell, Woodhead and Dutta) discovered a number of OX-K positive cases as well as OX-19 cases in various regions in India. Boyd in his conclusions suggested a close resemblance between the Indian OX-K positive cases and Malayan scrub typhus (tsutsugamushi disease). However, none of these authors found primary lesions in their cases, or any obvious association with jungle or scrub areas.

In Boyd's series of OX-K positive cases, one was from Burma, the first indication of the presence of tsutsugamushi disease in Burma. Maitra and Sen Gupta (105) reported the distribution of OX-K and OX-19 typhus in Burma. They considered the OX-K cases similar to Malayan scrub typhus (tsutsugamushi disease without primary lesion). Mehta (109) found *Trombicula deliensis* on various small mammals in the Simla hills and suggested that it was the vector in that region; he also considered *Hyalomma aegyptium* (L.) as a possible vector.

There have been a few reports of tsutsugamushi from other Asiatic areas. In 1908 Ashburn and Craig (4) (5) after describing tsutsugamushi disease as it occurs in Japan presented two

⁴ Gunther has referred to this species as *Trombicula hirsti* var. *morobensis* Gunther 1939 (35), *Trombicula hirsti* var. *boloensis* Gunther 1939 (37) and *Trombicula minor* Serlese 1904 (38-39). Ewing (22) believes that the last name is not acceptable and that *Trombicula hirsti* Sambon should be used.

⁵ Boyd, J. S. K.: Fevers of typhus group in India; analysis of 110 cases reported in 1934. *J. Roy. Army M. Corps.* 65: 289-305, 361-367, November-December 1935.

cases of fever in the Philippines similar in only a few respects to tsutsugamushi disease. However, they made no actual statements as to the identity of their cases with the Japanese disease. Recently de Roda (17) found 47 positive Weil-Felix agglutinations in 500 cases of fever; 12 of these were OX-K positive. Five of the cases were from Manila and seven from provincial areas around Manila. No clinical or epidemiologic findings are given so that, although the evidence is suggestive, it does not clearly indicate the occurrence of tsutsugamushi disease in the Philippines.

Weir (181) (182) in 1915 described a "continued fever" from Korea which has been regarded by some as tsutsugamushi disease. The evidence for this is very obscure. Faust (23) in 1923 described two possible cases in the Yangtse Valley in China. It now appears that these probably were not tsutsugamushi disease.

ETIOLOGY

Many theories have been proposed to account for the etiology of tsutsugamushi disease. Baelz (6) rejected the mite transmission theory and proposed a miasmatic theory. Since that time plasmodia, enzymes from the mite larva, chlamydomyces, gregarines, "yeast-like organisms," and others have been described as etiologic agents. Although many investigators made important contributions it is probably the experiments and papers of Nagayo and his coworkers (126) (127) (128) that firmly established the rickettsial etiology. In 1930 they proposed the name, *Rickettsia orientalis*, for the organism with which they were working, and because of the wide publicity which their paper attained this name was widely accepted. It now appears, however, that the organism was probably first observed by Hayashi as early as 1908. Later, in 1920, this author (43) described the organism as *Theileria tsutsugamushi*, noting its pleomorphic nature. At the 1930 congress of the Far Eastern Association of Tropical Medicine, N. Ogata (135) described *Rickettsia tsutsugamushi*, a non-filterable, pleomorphic, gram-negative organism which he had found in 1928, as the etiologic agent in tsutsugamushi disease. Later Ogata concluded that this organism was the same as the *Theileria tsutsugamushi* of Hayashi and that the correct name should be *Rickettsia tsutsugamushi* Hayashi 1920. Nagayo et al. contended, however, that *Rickettsia orientalis* should be retained since the organism is not pleomorphic, and that only one of the so-called pleomorphic forms of Hayashi and Ogata was the actual etiologic organism, and that *Rickettsia tsutsugamushi* therefore was not acceptable.

This argument, however, was based on a misunderstanding of the rules of nomenclature which would allow Nagayo et al. only to restrict the use of *Rickettsia tsutsugamushi* but not to introduce a new name. The more recent Japanese literature favors the pleomorphic concept of *Rickettsia tsutsugamushi* with a few investigators leaning toward cyclic theories. Morishita (117) has pointed out that more work needs to be done to prove that the *Rickettsia tsutsugamushi* of Hayashi was actually the etiologic organism although the evidence seems now to indicate that it was.

Pinkerton (142) in a review of the literature on *Rickettsia* accepts *Rickettsia tsutsugamushi* and relegates *Rickettsia orientalis* to synonymy. The authors of this paper agree with his interpretation. *Rickettsia tsutsugamushi* has also been accepted in the recent discussion of the disease by Ahlm and Lipshutz (1).

Other names have appeared in the literature. *Rickettsia nipponica* Sellards 1923 (154) is now regarded as unrelated to *tsutsugamushi* disease. *Rickettsia akamushi* Kawamura and Imagawa 1931, described from the salivary gland of the *akamushi* mite, has been shown to be *Rickettsia tsutsugamushi* and therefore becomes a synonym. *Rickettsia tsutsugamushi-orientalis* Kawamura 1934 is merely a compromise name created to pacify both the Nagayo and the Ogata-Hayashi schools. This has no place in nomenclature and is therefore another synonym of *Rickettsia tsutsugamushi*. Philip (141) regards *Rickettsia orientalis* var. *schüffneri*, *Rickettsia megawi*, *Rickettsia megawi* var. *fletcheri*, and *Rickettsia megawi* var. *breinli*, all proposed by de Amaral and Monteiro in 1933 (19) as synonyms of *Rickettsia orientalis* which in turn is a synonym of *Rickettsia tsutsugamushi*. This seems to be sensible until further experimental work can actually establish the validity of these varieties and species of *rickettsia*. Philip also includes *Rickettsia pseudotyphi* Vervoort 1938, in this group. Kouwenaar and Wolff (85) in 1942 proposed *Rickettsia sumatrana* as the name for the Sumatran strain which they regard as the same as that of Malaya.

Except for the acceptance of *Rickettsia tsutsugamushi* as the correct name for the Japanese strain, the entire question of nomenclature for the *tsutsugamushi rickettsiae* must await further experimental work on the relationships of the various strains isolated.

VECTORS

The early Chinese literature as well as the Japanese folklore associated *tsutsugamushi* disease with trombiculid larvae long before the advent of scientific investigations. Although Baelz

and Kawakami (6) in 1879 rejected the mite theory, it was revived by Tanaka as early as 1892. By 1920 the investigations of Kitashima and Miyajima, Nagayo et al., Kawamura et al., and Hayashi et al. had not only demonstrated the life cycle of *Trombicula akamushi* Brumpt but had also implicated this species as the vector of tsutsugamushi disease. The experiments of Kawamura (61) in 1918 also established the fact that the etiologic organism is transmitted from one generation of mites to the next via the ova.

The life cycle of *Trombicula akamushi* as described by Japanese investigators does not differ greatly from other chiggers. The eggs are laid singly in the soil. The orange-red hexapod larvae (chigger) which emerge from the eggs vary in length from 0.30 to 0.40 mm. These larvae are very active and run about on the ground litter and to a certain extent on the lower vegetation. These larvae are known to attack a considerable variety of warm-blooded vertebrates. Digestive fluids are injected into the tissues of the host and the resulting semi-digested material is withdrawn by the mite larvae. After becoming fully engorged the larvae drop to the ground and become quiescent. During the ensuing period the appendages and certain other organs undergo histolysis. When the appendages reform they lie next to the body under the larvae skin and have no setae or armature of any kind. This stage is known as the nymphochrysalis. From the nymphochrysalis emerges the active octopod nymph which is similar to the adult although smaller. This nymph remains in the soil and feeds on the juices of plants, particularly those of the roots. The nymphs evolve into the adults which also live in the soil. The sexes are externally similar except for slight differences in the genital region. In temperate regions there is a single generation per year. Most of the summer is passed in the larval stage and the winter in the adult stage.

In 1922 Walch (173) (174) first suggested *Trombicula deliensis* Walch as the vector in Sumatra. This suggestion was based largely on its morphologic similarity with *Trombicula akamushi* and the fact that *Trombicula deliensis* was found parasitic on both man and wild rats. Later Walch and Keukenschrijver (179) (180) were able further to implicate *Trombicula deliensis* as the vector with experiments using infected mites and a laboratory monkey. Although these experiments were not entirely conclusive the role of *Trombicula deliensis* in the transmission of tsutsugamushi disease in Sumatra has been generally accepted. Walch also suggested *Trombicula schüffneri* Walch as a possible vector. This suggestion was revived recently by Kouwenaar and Wolff (85). Gater (31), on the basis of epidemiologic evidence, has suggested both *Trombicula deliensis* and *Trombicula akamushi* as vectors in Malaya. Heaslip (56), on epidemiologic basis, has suggested *Trombicula deliensis* also as a vector in northern Australia. Gunther (35) (37) (39), also on the basis

of epidemiologic observations, has suggested *Trombicula hirsti*⁶ as the vector in New Guinea.

The natural hosts of *Trombicula akamushi* are numerous. Although in Japan it is regarded as primarily an ectoparasite of the field vole, *Microtus montebelli montebelli* (Milne-Edwards), Kawamura has recorded it also from the roof rat, *Rattus rattus alexandrinus* (I. Geoffroy); as well as moles, monkeys, rabbits, guinea pigs, mice, dogs, and cats in the endemic regions. In Formosa it has been found by Hatori parasitizing the common Indian rat, *Rattus rattus rufescens* (Gray) and Norway rat, *Rattus norvegicus* (Berkenhout); on two insectivores, *Suncus myosurus Swinhoei* (Blyth) (= *Crocidura muschata*, Hatori (40) and *Crocidura tanakae* Kuroda (= ? *Sorex dzinezumi* Hatori (40); as well as dogs, cats, and calves. In Malaya, Gater has found the *Trombicula akamushi* larvae on the Malaysian house rat, *Rattus rattus diardii* (Jentink) and the Malaysian field rat, *Rattus rattus jalorensis* (Bonhote). Morishita states that in Formosa the larvae are parasitic on *Rattus rattus rufescens* (Gray), *Rattus losea* (Swinhoe), *Rattus coxinga* (Swinhoe), *Rattus norvegicus*, *Apodemus agrarius ningpoensis* (Swinhoe), *Mus musculus taiwanus* Horikawa, dog, ox, and buffalo.

Among birds *Trombicula akamushi* parasitizes a still greater number of species. Hayashi, in Japan, found the larvae of this species on young quail and a species of warbler, *Acrocephalus arundinaceus orientalis* (Temminck and Schlegel). Kawamura reported finding these larvae on the brush-dwelling and ground-dwelling species of five orders of birds: Passeriformes, Galliformes, Charadriiformes, Cuculiformes, and Micropodiformes. In Formosa Hatori reported pheasants, quail, kingfishers, goatsuckers, and cuckals infested. It has been observed by Kawamura as a common ectoparasite of the domestic fowl.

Trombicula deliensis larvae have been reported as parasites of *Rattus rattus diardii* and *Rattus concolor* in Sumatra by Walch and of *Rattus rattus diardii* and *Rattus rattus jalorensis* in Malaya by Gater. Three species of birds, *Centropus javanensis* (Dumont), *Excalfactorius chinensis* (L.), and *Rhinortha chlorophaea* (Raffles) are also known as hosts in Sumatra.

Trombicula hirsti, possibly a vector in New Guinea has among its hosts, according to Gunther (39), the bandicoot, *Echimidipera cockerelli* Ramsay; bush pig, *Sus papuensis* Lesson; bush fowl, *Megapodius reinwardt reinwardt* Dumont (= *Megapodius duperreyi*, Gunther, (39)) bush turkey, *Talegallus jobiensis jobiensis* (A. B. Meyer); cassowary, *Casuarus casuarus* (L.); ground pigeon, *Gallicolumba jobiensis jobiensis* (A. B. Meyer); the rail, *Amaurornis olivacea nigrifrons* (Hartert) (= ? *Amaurornis moluccensis nigrifrons*, Gunther, (39)) and swamp hen, *Prophyrio poliocephalus melanotus* Temminck (= *Prophyrio melanotus*, Gunther (39)).

Because of the feeding habits of chiggers, in so far as known at present, the transmission of tsutsugamushi disease differs markedly from that of other arthropod-borne diseases, such as plague, malaria, and filariasis. The difference is due to the fact that the trombiculid mite takes only a *single meal* from a *single host* during its life cycle. The rickettsiae have been shown (61) to pass from the adult female to her offspring via the ova. *This means that following the infection of a larva by feeding on an*

⁶ See previous note on taxonomic nomenclature concerning this species.

infected host, the rickettsiae are not transmitted to another vertebrate host until the infected larva has completed its life cycle and has produced a new generation of larvae, and then only if these larvae have received the organisms from the mother via the ova. (See note at end of article, page 836.)

RESERVOIR HOSTS

Although tsutsugamushi disease is obviously primarily a disease of wild animals there is very little reliable information on the natural or reservoir hosts of the rickettsiae. Several species of mammals have been found whose sera agglutinate OX-K antigen. Among them are several species of rats in Indo-China, Malaya, Sumatra, Java, India, and Australia; a species of wild hog in Sumatra; and bandicoots in Australia. There is considerable evidence to indicate that the mere fact that the sera of such animals agglutinate OX-K antigen is by no means sufficient evidence to assume that they harbor the rickettsiae. Dutch investigators (Kouwenaar, Wolff et al.) have rejected this type of evidence. Vaucel and Bruneau (167) for example, in Hanoi, Indo-China, found OX-K positive rats but subsequent investigations showed them to be infected with an OX-K strain of the proteus bacillus, which accounted for the positive Weil-Felix. In Sumatra, Walch regarded two species of rats as reservoirs because he found their spleens enlarged in the endemic areas. Since such enlargement may be due to several other causes his conclusions must be discarded until supported by other evidence.

In Japan it is well established that at least the field vole, *Microtus montebelli montebelli*, is a reservoir host since it has been possible to demonstrate its natural infection with *Rickettsia tsutsugamushi*. In addition Hayashi (47) (48) has also found several species of birds including sparrows, red thrushes, pigeons, ducks, and the domestic fowl to be infected in the endemic regions. The strains isolated from birds were found to be milder and it has been suggested that some of the milder human cases are due to these strains. There is some experimental evidence to substantiate this. In Formosa a strain of *Rickettsia tsutsugamushi* has been isolated from *Rattus losea*, the yellow-bellied country rat, by Morishita (117) who believes that this species and *Apodemus agrarius ningpoensis*, the line-backed field mouse, are the principal reservoirs in Formosa; he suspects *Rattus rattus rufescens*, the common Indian rat, in the Pescadores. Heaslip (56) was able to demonstrate rickettsiae in a single specimen of *Rattus conatus* in Queensland. Attempts to find natural infections with *Rickettsia tsutsugamushi* in rats in Java and Sumatra

have been unsuccessful although at least one of the species has been shown to be susceptible experimentally.

A great deal of investigation is needed concerning this phase of the epidemiology of tsutsugamushi disease. It is important that mammals other than rats also be investigated. In addition attention should be given to the role of birds not only as hosts of the vectors but also as hosts of the rickettsiae. Evidence concerning both has already been presented. Hayashi (47) (48), Sambon (149), Kawamura (61) and Mühlens (118) have all suggested that birds may have important roles in the epidemiology of tsutsugamushi disease. There can be little doubt that birds represent the most important means by which the trombiculid mites are dispersed, especially in insular areas. The mild nature of the disease in some areas is suggestive of the mild nature of both experimental and natural avian infections.

In summary, definite proof of the cycle necessary for transmission of the disease has not been established, except in one case, because of the experimental difficulties encountered. It should rest finally on demonstrations of the etiologic agent's presence in reservoir hosts, and in mites proved to transmit the organism from such reservoirs to man. To date this has been accomplished only in the case of *Trombicula akamushi* and the field vole, *Microtus montebelli*, in Japan.

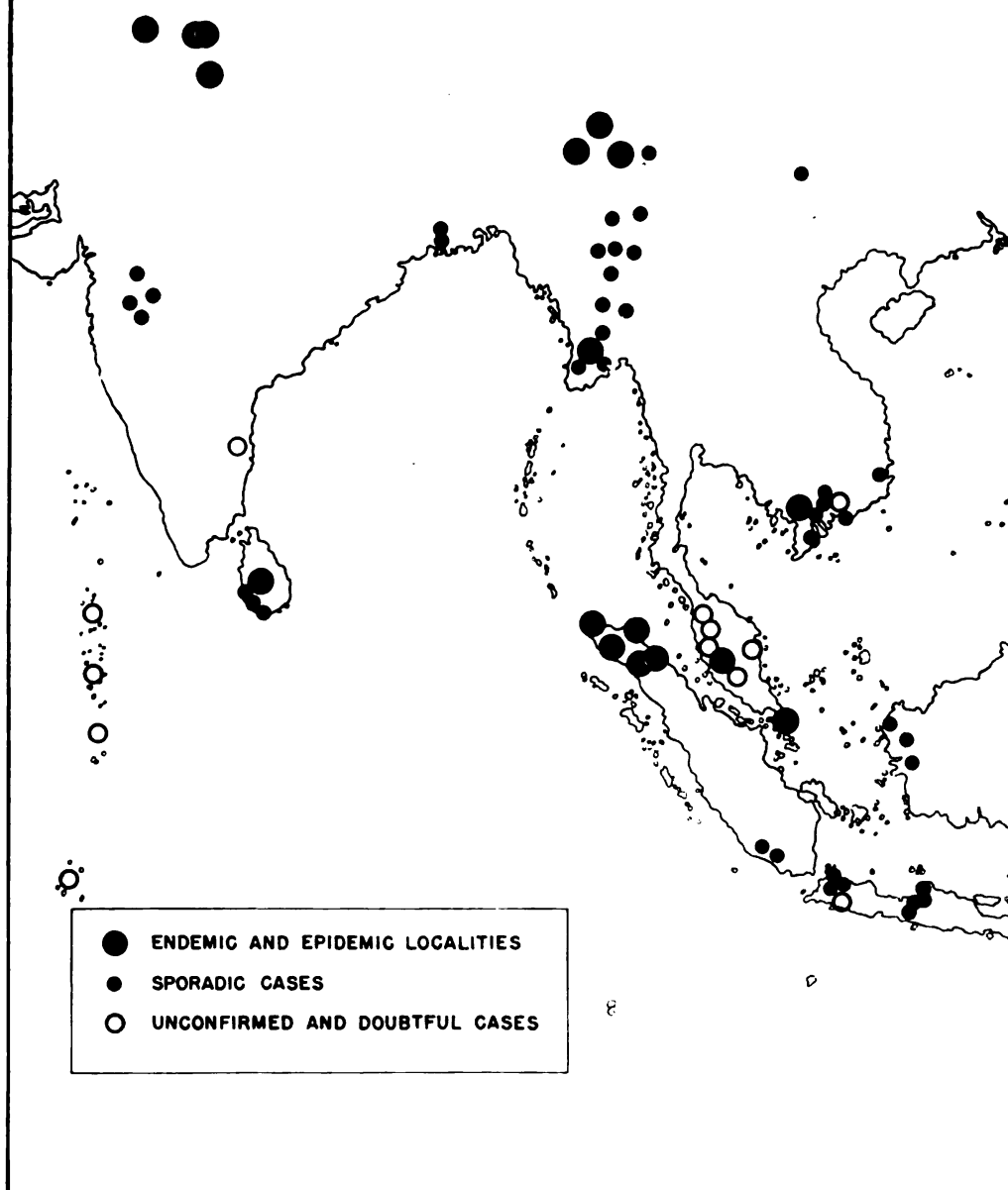
GEOGRAPHIC DISTRIBUTION AND VARIATION

The distribution of tsutsugamushi disease, except in Japan and Formosa, is incompletely known. It has been encountered during the present war in areas where it was previously unknown and unsuspected. At the present time little is known concerning the factors which actually determine its distribution. Information on the vectors and reservoir host is too inadequate to attempt to show any correlation between them and the occurrence of tsutsugamushi disease. Geographically the disease shows considerable variation. Whether or not these variations can be attributed to strain variations in the rickettsiae, different vectors, different reservoir hosts, or differences in the people infected cannot be ascertained at the present time. *Provisionally it seems best to assume that tsutsugamushi disease is primarily a widespread disease of several (or many) species of vertebrate animals in Asia and Australasia, transmitted by certain trombiculid larvae, and contracted accidentally by humans in contact with habitats containing the mite larvae.*

Japan.—In Japan proper, tsutsugamushi disease is confined to the northwestern part of the island of Honshu. The endemic

GEOGRAPHIC DISTRIBUTION of TSUTSUGAMUSHI DISEASE

BASED ON A SUMMARY OF AVAILABLE REPORTS





areas are restricted to the flood areas of the Shinano and Akano rivers in Niigata Prefecture, the Omono River in Akita Prefecture, and the Mogami River in Yamagata Prefecture. Most of the cases occur in summer, particularly in July and August, although some cases are reported also in June, September, and October. The disease is confined almost exclusively to hemp workers in the endemic areas. The annual number of cases formerly varied from 50 to 250 although in recent years it is stated that this number has been substantially reduced by various prophylactic measures. The case mortality is 30 to 40 percent (Kawamura (61)). The primary lesion is almost invariably present.

Formosa.—On the main island tsutsugamushi is widely distributed, not only in the plains but also in the mountains up to 6,500 feet. The endemic areas are poorly defined. Although the majority of the cases come from Karenko and Taito in the east, cases have been reported from all parts of the island. Cases have been reported in every month of the year; however, the incidence is lowest in February, March, and April. The disease is contracted primarily by out-of-door laborers such as charcoal burners, sugar cane planters, etc. The annual number of cases from 1923 to 1938 (Morishita (117)) has varied from 18 (1935) to 163 (1932). The average case mortality is 12 percent, increasing from 3.3 percent among children less than 5 years of age to more than 40 percent in those over 56. Among the Japanese in Formosa it is 20.4 percent, whereas among the Formosan Chinese it is 10.3 percent and nil among the aborigines. There are occasional cases without primary lesions. It is contracted along river sides, in cultivated fields, foothills, jungles, and other rural habitats.

Pescadores.—Many of the islands which are inhabited principally by Formosan Chinese are endemic areas. The epidemiology of tsutsugamushi in this group of islands is peculiar in that the endemic areas surround the dwellings immediately. Trombicula akamushi develops in the ground around the coral walls constructed to protect vegetables from the sea winds. The reservoir is thought to be *Rattus rattus rufescens*, a household pest (and possibly the domestic fowl). This peculiar epidemiology is reflected in the fact that 38 percent of the cases are in children less than 5 years and 70 percent in children under 15 years. Among adults men and women are infected in approximately equal numbers. The number of cases reported annually since 1932 has varied from 12 (1933) to 80 (1937). The average case mortality is 5.6 percent. The low case mortality is probably due to the milder strain of rickettsia (73) involved and also to the

fact that the majority of the cases occur in children under 15. The primary eschar is invariably present according to Kawamura (73) although it seems possible that some mild cases without eschar might occur without detection.

French Indo-China.—Reports are confined to isolated cases and very small epidemics. Cases have been recorded from most parts of the country although there are not enough data to designate any endemic areas. There are numerous reports of cases without primary lesion. Many of the cases reported have been among Europeans. Data are too scanty to give an accurate case mortality rate.

Siam.—No published reports of tsutsugamushi disease in Siam could be found. However, in consideration of its occurrence in French Indo-China and Malaya it seems likely that it is present there.

China.—Careful consideration of the two cases reported by Faust (23) in 1923 in the Wuhan area of the central Yangtse Valley leads to the conclusion that they were not tsutsugamushi disease. In the Kunming area in southern China there are unpublished records of OX-K positive cases. These are the only reliable reports of tsutsugamushi disease in modern China which have come to the attention of the authors. It is possible that it will be found elsewhere in China.

Korea.—The report of Weir (181) (182) concerning cases of a fever of unknown etiology at Chemulpo has been regarded by some as tsutsugamushi disease. It is very difficult to understand how this description could be interpreted as tsutsugamushi disease. Therefore it seems unjustified to consider tsutsugamushi disease as occurring in Korea on the basis of this report.

Malaya.—In Malaya tsutsugamushi disease has been reported from the states of Kedah, Selangor, Pahang, Perak, and Negri-Sembilan and is considered to be focally distributed throughout the country. However, most of the cases reported by Fletcher, Lewthwaite, Anigstein, et al., occurred in or near Kuala Lumpur. Subrahmanyam (160) found 16 cases in and near Singapore. The features of the disease in Malaya are, briefly, its lack of seasonal incidence, its association with lalang (a tall coarse grass, *Imperata cylindrica*) or other scrub grasses, and the low incidence of the primary lesion. The case mortality in 1940 (101) (102) was about 15 percent, the highest rate recorded in this area up to the present time.

Philippine Islands.—It seems unlikely that the two cases reported by Ashburn and Craig (4) (5) on Samar in 1908 were actually tsutsugamushi disease. In 1937 de Roda (17) reported

a number of OX-K positive cases from Manila and surrounding area. Because the titers of these cases were not particularly convincing it is difficult to be certain that tsutsugamushi disease was involved. Nevertheless it is safer to anticipate encountering the disease in the Philippines.

Borneo.—Three cases have been reported from West Borneo (7) (87). Because of the sparse population, medical service in Borneo has been very meager. It is possible that tsutsugamushi disease could be widespread.

Celebes.—Tsutsugamushi disease has been reported as common in northeastern Celebes in the area around Minahassa (139). The primary lesion was noted as very infrequent.

Sumatra.—Tsutsugamushi disease occurs epidemically and sporadically in Sumatra. Epidemics have varied in size from a few cases to as many as 200. It is contracted almost exclusively by native laborers working in jungle grass in cut-over areas such as old plantation fields which have been idle for a period of time. Most of the cases are recorded from altitudes of 1,000 feet or more. Case mortality in Sumatra is about 3 percent. It is usually observed that about 40 percent of the cases have the primary lesions.

Java.—This island with its 40,000,000 inhabitants had reported less than 40 cases of tsutsugamushi disease up to 1940. These have occurred as sporadic isolated cases in various parts of the island.

Lesser Soenda Islands and the Moluccas.—No reports of tsutsugamushi disease have come to the attention of the authors. However, because of its occurrence in Java, Sumatra, Borneo, Celebes, and New Guinea it will be well to take the necessary precautions on these islands.

New Guinea.—Tsutsugamushi disease has been reported in many areas in northern British New Guinea. Among these are Wau, Upper Watut, Bulolo-Bulu, Ramu, Madang, Green River, Maprik, Aitape, and Wewak. Also it has been recorded from Karkar Island, Goodenough Island, New Britain, New Georgia and elsewhere in the Admiralty Islands.

Corbett⁷ has described in detail the pathology of tsutsugamushi disease as it occurred in U. S. Army personnel in New Guinea.

Australia.—The disease in Australia appears to be limited entirely to the coastal region of North Queensland from Cooktown on the north to Sarina on the south. Persons engaged in

⁷ Corbett, A. J.: Scrub typhus. Bull. U. S. Army M. Dept. No. 70: 34-54, November 1943.

sugar cane cutting, timber getting, scrub falling or clearing, and other similar rural occupations contract the illness. About 2,000 cases have been observed in this region. A primary lesion was noted in about 10 percent of the cases. The mortality rate ranged from 1 percent to 27 percent, the latter figure being reported in only one outbreak. Unwin (166) stated that many patients had two or three attacks, the subsequent ones being milder than the initial attack, indicating the development of a partial immunity as a result of the first attack.

India.—Largely on the basis of positive OX-K agglutinations, it is believed that two endemic foci of this disease exist in the region of the Simla hills and in Assam in India. OX-K positive cases have also been reported from the Lahore district, Meerut, Deccan, Bombay, and Madras. The presence of a primary lesion has only rarely been reported.

Burma.—OX-K positive typhus cases, similar to the "rural" typhus of Malaya have been reported in at least 17 districts of Burma, so apparently tsutsugamushi disease is widespread. No eschars were noted. It occurs in regions of high, as well as low altitude.

Ceylon.—Nicholls (130) in addition to describing a typical case with a positive OX-K agglutination, mentioned the previous finding of 6 other OX-K positive cases in Ceylon. His patient was evidently infected on the east coast of Ceylon. There are more recent unpublished reports of tsutsugamushi disease from this island.

Maldivé Islands.—Cases of tsutsugamushi disease or a similar disease have been reported from many of these islands.

Asiatic Russia.—There are reports that tsutsugamushi disease occurs in eastern Siberia. More specific data and information on these are necessary before this area is included in the range of tsutsugamushi disease.

Micronesia.—Esaki⁸ has reported chiggers (trombiculid mites) as numerous in the western Carolines. They are the cause of the "red bug itch" which is common on these islands. The actual species of mites occurring on these islands apparently has not been determined although some of the larvae have been reared successfully. No reports of the occurrence of tsutsugamushi disease in these islands have come to the attention of the authors.

⁸ Esaki, T.: Arthropods injurious to man in the South Sea Islands mandated to Japan (Report 1). Commemorative Volume for Prof. Sadao Yoshida (collected papers). Vol. 1, pp. 230-252. Osaka Natural History Society at the Institute for Research in Microbic Diseases, Osaka Imperial University, Osaka, Japan, 1939. (In Japanese.)

The following statement has been translated from Esaki's account of the Micronesian chiggers:

Fortunately these insects (chiggers) do not transmit a dangerous disease like the tsutsugamushi in Japan but nevertheless are unpleasant pests indeed to meet with.

PROPHYLAXIS

Because of the association of trombiculid larvae with the transmission of tsutsugamushi disease the classic and most effective prophylactic measures have been those which prevent attacks by these larvae. This has been true in all of the areas in which tsutsugamushi disease occurs. Japanese, Dutch and Malayan literature suggests various repellents and clothing devices for prevention of the mite bites. Japanese investigators have made considerable investigations into the possible use of prophylactic vaccines. More notable among these are Hayashi's live avian strain vaccine (47) (48), the live Pescadores (human) strain vaccine of Kawamura et al. (64) (68) and the vaccine of Hayashi and Kato (54) (59) prepared from the steam-treated lymph glands of infected laboratory animals. In the last, chickens were used to obtain a weak vaccine whereas laboratory mammals were used in obtaining a stronger vaccine. The data presented by Hayashi and Kato seem to indicate a considerable degree of success with the steam-treated vaccine.

At the present time, the following measures are considered of value in prevention of the disease in many regions. A thorough clearing of all jungle, scrub and other grasses or underbrush of the area and adjacent regions should be made down to the bare earth. Vegetation thus removed should be burned. Sanding over the area may be advisable. Sprinkling of powdered sulfur on the vegetation along paths and in areas where personnel are exposed to the larvae has been found to be effective. The control of reservoir hosts is impractical until further information is available.

The personal measures for protection are directed toward avoidance of mite bites. The wearing of high boots, leggings, the tucking into socks of the trouser legs, and adequate covering of the other exposed portions of the body before venturing into mite infested regions should be practiced. Bathing with plenty of soap and water and the donning of fresh clothes as soon as possible after exposure to mites are important measures. Avoidance of contact with infested grasses must be carried out by not sitting or lying on the grass. Sleeping accommodations should be raised at least six inches above the ground or higher, and grass should not be used to stuff mattresses or pillows.

Recently, an effective mite repellent has been devised which, when applied to the skin by hand, protects against mites for about one or two hours. When applied to clothing by hand or "wet" spray, particularly around the openings of clothes it protects for about one week or longer, unless washed off by laundering or rain.

No effective vaccine has been developed as a protective measure, except possibly one of those described by Japanese workers.

GLOSSARY

The purpose of this glossary is to list with brief explanations various terms which have been applied to tsutsugamushi disease. An attempt is made to explain the manner in which each was used and to indicate its origin when it is obscure. The list is by no means complete but it will be found to include most of the names for tsutsugamushi disease which have been employed in the literature.

AKAMUSHI-BYO.—(From Japanese *aka-mushi*, the pronunciation of two Chinese ideographs meaning red creature or red bug, and old Chinese *byo*, disease.) Synonym of tsutsugamushi disease used only in Japanese papers in the Japanese language.

AKAMUSHI DISEASE.—English equivalent of *akamushi-byo*. Synonymous with tsutsugamushi disease and used formerly by Japanese authors in writing in English and by a few English authors.

AKAMUSHI-KRANKHEIT.—German equivalent of *akamushi-byo*. Synonymous with tsutsugamushi disease. This term has been used by German authors and Japanese authors writing in German.

ATYPICAL TSUTSUGAMUSHI.—Used by Morishita (115) (116) and Kawahigasi (60) in designating cases in Formosa without primary lesions.

AUSTRALIAN MITE FEVER.—Used occasionally in referring to tsutsugamushi disease with primary lesion in Australia.

BATRAN FEVER.—Local name for tsutsugamushi disease in Formosa.

COASTAL FEVER.—A term used for a group of fevers of unknown etiology in North Queensland which probably included many cases of tsutsugamushi disease.

DELI FEVER.—Occasionally used by authors writing in English in referring to pseudotypoid fever of Deli as described by Schüffner. See pseudotypoid of Deli.

ENDEMIC GLANDULAR FEVER.—An early term used in Australia referring to the striking regional lymphadenopathy. See also Mossman fever.

ENDEMIC TROPICAL TYPHUS.—Used by some Australian authors in designating their tsutsugamushi disease.

ENDEMIC TYPHUS.—An unfortunate designation for tsutsugamushi disease in Australia and New Guinea by Gunther and others.

EXANTHEMATOUS BUBONIC FEVER.—Proposed by Hatori (40) for the tsutsugamushi disease for Formosa but never adopted by other authors.

FALSE TYPHUS OF DELI.—An incorrect translation from the German of Schüffner's *pseudotypoid of Deli* (written in German as *Pseudotyphus*). See pseudotypoid of Deli.

FIÈVRE DE BOIS.—(French, fever of the woods.) A term used in French Indo-China around 1900. It is possible that some of the cases thus diagnosed were tsutsugamushi disease.

FIÈVRE EXANTHÉMATIQUE AVEC ULCÈRE PRIMAIRE.—(French, exanthematous fever with primary lesion.) A term used in French Indo-China for cases of tsutsugamushi disease with primary lesion.

FIÈVRE FLUVIALE DE JAPON.—(French, Japanese river fever.) Synonym of tsutsugamushi disease used in French Indo-China.

FLOOD FEVER.—An uncommon English synonym of tsutsugamushi disease.

HORIN FEVER.—A local name for tsutsugamushi disease in Formosa.

INDIAN MITE TYPHUS.—A term used for tsutsugamushi disease in India.

INDIAN TROPICAL TYPHUS.—An ambiguous term usually including tsutsugamushi disease without primary lesion and endemic murine typhus although sometimes applied to either.

INDIAN TICK TYPHUS.—This term has probably been applied erroneously to cases of tsutsugamushi disease in India along with rickettsioses, some of which are similar to Rocky Mountain spotted fever and others of undetermined classification.

JAPANESE FLOOD FEVER.—An English equivalent of tsutsugamushi disease.

KEDANI-BYO.—(From Japanese *ke-dani*, hairy mite, and old Chinese *byo*, disease.) A Japanese synonym of tsutsugamushi disease.

KEDANI DISEASE.—English equivalent of *kedani-byo*.

KEDANI FEVER.—Same as *kedani disease*.

KEDANI-KRANKHEIT.—German equivalent of *kedani-byo*. Synonym of tsutsugamushi disease used extensively by Japanese authors writing in German prior to 1920.

KEDANI RIVER FEVER.—Another English equivalent of *kedani-byo*.

MALAYAN RURAL TYPHUS.—The tsutsugamushi disease of Malaya as applied to cases without primary lesion. Synonymous with *scrub typhus*.

MIJTEKOORTS.—(Dutch, mite fever.) Used extensively by Dutch authors, usually to designate cases of tsutsugamushi disease with primary lesion although sometimes as synonym of tsutsugamushi disease of Sumatra, Java, etc.

MITE FEVER.—Same as *mijtekoorts*. Used principally by Dutch authors writing in English.

MITE FEVER OF SUMATRA.—Same as mite fever but used at a time when the disease was not known outside of Sumatra.

MITE TYPHUS.—A term proposed as parallel to flea typhus (endemic), louse typhus (epidemic), and tick typhus to include all typhus borne by mites. It is synonymous with tsutsugamushi disease as used in this compilation.

MOKKIN FEVER.—A local name for tsutsugamushi disease in Formosa.

MOSSMAN FEVER.—An old local name for tsutsugamushi disease in North Queensland. Other fevers of unknown etiology may have been included.

PSEUDOTYPHOID OF DELI.—(Also pseudotyphoid fever of Deli.) The original name applied to the tsutsugamushi disease of Sumatra by Schüffner and Wachsmuth (152) (153). Although these authors included in their diagnoses both cases with and without primary lesions, the term was later (179) (180) restricted to only those cases with primary lesion.

PSEUDOTYPHUS OF DELI.—An incorrect translation of Schüffner's "Pseudotyphus" (German *Pseudotyphus* = English pseudotyphoid) which has been used extensively by English and American authors. That Schüffner meant *pseudotyphoid* is borne out by the fact that his description compared the

Sumatran disease with typhoid fever and furthermore that in his papers in English (150) (153) he used *pseudotyphoid fever*.

RIVER FEVER.—A rather rare English synonym of tsutsugamushi disease.

RURAL TYPHUS.—A term for tsutsugamushi disease without primary lesion. Used extensively in Malaya, Netherlands Indies and Indo-China. See scrub typhus.

SARINA FEVER.—Local name for tsutsugamushi disease (and perhaps other fevers of unknown etiology) in North Queensland, Australia.

SCRUB TYPHUS.—A term used extensively in Malaya, Burma, and the Netherlands Indies to designate cases of tsutsugamushi disease without primary lesion or, in other words, cases of so-called "tropical typhus" occurring in scrub or rural areas. More recently certain American and English authors have applied *scrub typhus* to the tsutsugamushi disease (with or without primary lesion) over much of its range, thus making this usage of scrub typhus synonymous with tsutsugamushi disease.

SEULIMEUM FEVER.—Local name for tsutsugamushi disease in northwestern Sumatra.

SHASHITSU-BYO.—(From old Chinese *sha*, sand; *shitsu*, louse; and *byo*, disease.) A local Japanese synonym of tsutsugamushi disease.

SHASHITSU DISEASE.—English equivalent of *shashitsu-byo*. Cited rarely by early authors as synonym of tsutsugamushi disease.

SHIMAMUSHI-BYO.—(From Japanese *shima-mushi*, striped or insular creature or bug, and old Chinese *byo*, disease.) A local name for tsutsugamushi disease in Japan.

SHIMAMUSHI DISEASE.—English equivalent of *shimamushi-byo*. Cited rarely by early authors as synonym of tsutsugamushi disease.

SUMATRAANSCHÉ MIJTEKOORTS.—(Dutch, Sumatran mite fever). See mijtekoorts.

SUMATRANISCHES MILBENFIEBER.—(German, Sumatran mite fever.) Used by Dutch authors writing in German. See mijtekoorts.

TROPICAL TYPHUS.—An ambiguous term used extensively in the literature of Malaya and the Netherlands Indies (particularly from 1920 to 1935). It included all typhus in these areas *without* primary lesion; hence both *tsutsugamushi disease* (OX-K positive) without primary lesion and endemic murine typhus (OX-19 positive). The term has also been applied individually to murine typhus and tsutsugamushi disease without primary lesion. However, these were usually qualified as the *urban* or *shop* and *scrub* or *rural* types respectively of *tropical typhus*. *Tropical typhus*, as a term, should be abandoned.

TSUTSUGAMUSHI-BYO.—(From *tsutsuga-mushi* the Japanese pronunciation of two Chinese ideographs meaning small creature, which, according to early Chinese literature, caused disease by boring into the human body, and old Chinese *byo*, disease.) This has become the accepted name for the rickettsiosis caused by *Rickettsia tsutsugamushi* in Japan.

TSUTSUGAMUSHI DISEASE.—(Sometimes transliterated as *tsutsugamuchi*.) English equivalent of *tsutsugamushi-byo*. This paper agrees with Lewthwaite as well as Burnet and Heaslip in using tsutsugamushi disease to include all mite-borne rickettsioses known at the present time, since the etiologic rickettsiae are certainly very similar. The authors of this paper, however, are well aware of the fact that a subclassification may ultimately be necessary as more information is accumulated on the relation of the various strains of the rickettsiae.

TSUTSUGAMUSHI FEVER.—Synonym of *tsutsugamushi disease*.

TSUTSUGAMUSHI-KRANKHEIT.—German equivalent of *tsutsugamushi-byo*.

TYPHUS BROUSSAILES.—(French, bush typhus.) Used in same manner as *scrub typhus*.

TYPHUS EXANTHÉMATIQUE TYPE FIÈVRE FLUVIALE.—(French, river fever type of exanthematous typhus.) Used in French Indo-China primarily to designate cases of tsutsugamushi disease with primary lesion.

TYPHUS RURAL.—(French, rural typhus.) Used in French Indo-China. See rural typhus.

TYPHUS TROPICAL.—(French, tropical typhus.) Used in French Indo-China. See tropical typhus.

UEBERSCHWEMMUNGSFIEBER.—(German, flood fever.) Synonym of tsutsugamushi disease used occasionally by Japanese and German writers prior to 1925.

BIBLIOGRAPHY

The following bibliography is restricted almost exclusively to those from which material has been derived for the purposes of this compilation. Although an attempt has been made to include all of the important papers, in many cases the decision as to which should be included and which should be omitted has been necessarily arbitrary. It should be emphasized that a complete bibliography on tsutsugamushi disease would contain several times the number of titles listed here. Many of the papers in the following list contain important bibliographies which can be consulted if necessary. Among these are Gunther (39), Kawamura (61), Kitashima and Miyajima (75) (76), Kouwenaar and Wolff (85), Lépine (90), Morishita (117), Ragiote and Delbove (146), and Biraud and Deutschman (8).

1. AHLM, C. E., and LIPSHUTZ, J.: Tsutsugamushi fever in the South-West Pacific Theater. J.A.M.A. 124: 1095-1100, April 15, 1944.
2. ALAIN, M., and DELBOVE, P.: Sur quelques cas de fièvre exanthématique avec "ulcère primaire" observés en Indochine méridionale. Bull. Soc. path. exot. 31: 453-456, June 8, 1938.
3. ANIGSTEIN, L.: Serological and pathogenic properties of the virus of tropical typhus. Far East. A. Trop. Med., Tr. Eighth Cong., 1928. pp. 120-131, 1930.
4. ASHBURN, P. M., and CRAIG, C. F.: A comparative study of tsutsugamushi disease and spotted or tick fever of Montana. Philippine J. Sc. (Sec. B.) 3: 1-23, January 1908.
5. Ibid.: A comparative study of tsutsugamushi disease and spotted or tick fever of Montana. Boston M. and S. J. 83: 749-761, May 7, 1908.
6. BAELZ, E., and KAWAKAMI, M.: Das japanische Fluss oder Ueberschwemmungsfieber, eine acute Infektionskrankheit. Arch. f. path. Anat. 78: 373-420, December 15, 1879.
7. BESSEM, N.: Een geval van mijtekoorts in der Westerafdeeling van Borneo. Geneesk. tijdschr. v. Nederl.-Indië 75: 1910-11, October 29, 1935.
8. BIRAUD, Y., and DEUTSCHMAN, S.: Typhus and typhuslike rickettsia infections. Geographical distribution and epidemiology; Europe and Mediterranean basin. Epidemiol. Rep., League of Nations 15: 99-160,

July-September 1936.

9. BREINL, A.; PRIESTLY, H.; and FIELDING, J. W.: On the occurrence and pathology of endemic glandular fever, a specific fever occurring in the Mossman district of North Queensland. *M. J. Australia* 1: 391-395, October 24, 1914.
10. BURNET, F. M.: Bancroft memorial lecture; rickettsial diseases in Australia. *M. J. Australia* 2: 129-134, August 22, 1942.
11. CHRISTIAN, C. R.: A case of typhus due to tick bite. *J. Roy. Army M. Corps* 59: 445-450, December 1932.
12. CILENTO, R. W.: Random observations on mite infestations of man. *M. J. Australia* 1: 552-554, May 19, 1923.
13. CLARKE, P. S.: Report on Mossman fever. Annual Report of Commissioner of Public Health, Brisbane, Queensland. Appendix F 1, p. 32, 1913.
14. DELBOVE, P.; CANET, J.; and TROUONG-VAN-HUAN: Note sure une petite épidémie de typhus tropical survenue dans un groupe de plantations du Cambodge. *Bull. Soc. path. exot.* 31: 457-460, June 8, 1938.
15. DELBOVE, P., and NGUYEN-VAN-HUONG: La réaction de Weil et Félix chez les rats de Saïgon-Cholon. *Bull. Soc. path. exot.* 30: 128-131, February 10, 1937.
16. Ibid.: Note au sujet d'un virus de "typhus tropical" isolé à Saïgon; infection expérimentale du cobaye. *Bull. Soc. path. exot.* 31: 86-89, February 9, 1938.
17. de RODA, A. P.: Typhus fever in the Philippines. Part I, Weil-Felix reaction of 500 febrile cases. *J. Philippine Islands M. A.* 17: 147-156, March 1937.
18. DINGER, J. E., and LENTJES, L. J. M.: Een geval van mijtekoorts. Diagnose door middel der dierproef. *Geneesk. tijdschr. v. Nederl.-Indië* 75: 1951-1954, November 12, 1935.
19. do AMARAL, A., and LEMOS MONTEIRO: Histoire naturelle et classification des Rickettsioses. Position systématique du "typhus exanthématique de S. Paulo." *Rev. sud-am. de méd. et de chir.* 4: 781-817, November 1933.
20. DOWDEN, R.: A suspected case of Kedani river fever in the Federated Malay States. *Indian M. Gaz.* 50: 208-211, June 1915.
21. EMANUELS, B. J.: Tropical typhus and tick fever in Atjeh. *Geneesk. tijdschr. v. Nederl.-Indië* 72: 196-205, February 15, 1932.
22. EWING, H. E.: Note on taxonomy of type species of mite genus *Trombicula* Berlese. *U. S. Nav. M. Bull.* 43: 837-839, October 1944.
23. FAUST, E. C.: The possible incidence of river fever (tsutsugamushi disease) in the Central Yangtze Valley. *China M. J.* 37: 979-987, December 1923.
24. FELIX, A., and RHODES, M.: Serological varieties of typhus fever. *J. Hyg.* 31: 225-246, April 1931.
25. FLETCHER, W.: Typhus-like fevers of unknown etiology with special reference to the Malay States. *Proc. Roy. Soc. Med. (Sect. Epidemiol. and State Med.)* 23: 1021-1027, May 1930.
26. Ibid.: Tropical typhus. *Brit. M. J.* 2: 1140-1141, December 24, 1932.
27. Ibid.: Typhus tropical et maladies de la même famille. *Bull. Office internat. d'hyg. pub.* 26: 95-110, January 1934.
28. Ibid.: Typhus fevers in Malaya. *Tr. Roy. Soc. Trop. Med. and Hyg.* 29: 111-112, July 1935.

29. FLETCHER, W.; LESSLAR, J. E.; and LEWTHWAITE, R.: The etiology of the tsutsugamushi disease and tropical typhus in the Federated Malay States. Part I. Tr. Roy. Soc. Trop. Med. and Hyg. 22: 161-174, August 1928.
30. Ibid.: The etiology of the tsutsugamushi disease and tropical typhus in the Federated Malay States. Part II. Tr. Roy. Soc. Trop. Med. and Hyg. 23: 57-70, June 1929.
31. GATER, B. A. R.: Entomological investigations in relation to tropical typhus in Malaya. Far East. A. Trop. Med., Tr. Eighth Cong., 1928. pp. 131-141, 1930.
32. GISPEN, R.: Het kweeken van rickettsiae in endeneieren. Geneesk. tijdschr. v. Nederl.-Indië 81: 1907-1925, September 9, 1941.
33. GUNTHER, C. E. M.: Endemic typhus in New Guinea. M. J. Australia 1: 813-814, June 29, 1935.
34. Ibid.: The serology of sixteen cases of endemic typhus in New Guinea. M. J. Australia 1: 439-440, March 20, 1937.
35. Ibid.: The probable vector of endemic typhus in New Guinea. M. J. Australia 2: 202-204, August 6, 1938.
36. Ibid.: Further observations on endemic typhus in New Guinea. M. J. Australia 1: 688-691, May 6, 1939.
37. Ibid.: Trombidiid larvae in New Guinea. (Acarina: Trombidiidae.) Proc. Linnean Society, New South Wales 64: 73-96, May 15, 1939.
38. Ibid.: A survey of endemic typhus in New Guinea. M. J. Australia 2: 564-573, November 30, 1940.
39. Ibid.: Endemic typhus in New Guinea: its occurrence and probable vector. Proc. 6th Cong. Pac. Sc. Assoc. (1939). 5: 715-724, 1942.
40. HATORI, J.: On the endemic tsutsugamushi disease of Formosa. Ann. Trop. M. 13: 233-258, December 1919.
41. HAYASHI, N.: Eine vorläufige Mitteilung über Untersuchungen betreffs der Tsutsugamushikrankheit. Hokuyetsu Igakkai Kaiho 21: 397, 1906. (In Japanese.)
42. Ibid.: Über den Erreger der Tsutsugamushi-krankheit. Hokuyetsu Igakkai Kaiho 22: 51-70, 1907. (In Japanese.)
43. Ibid.: Etiology of tsutsugamushi disease. J. Parasitology 7: 53-68, December 1920.
44. Ibid.: On tsutsugamushi disease. Tr. Jap. Path. Soc. 21: 448-451, 1931.
45. Ibid.: On tsutsugamushi disease. Tr. Jap. Path. Soc. 22: 686-690, 1932.
46. HAYASHI, N., et al.: Results of the study of tsutsugamushi disease during 1922. Tr. Jap. Path. Soc. 13: 30-31, 1923.
47. Ibid.: Ergebnisse der Studien über die Tsutsugamushi-Krankheit im Jahre 1923. Tr. Jap. Path. Soc. 14: 197-198, 1924.
48. Ibid.: The relation between birds and tsutsugamushi disease (contribution II), a note on a constructive preventative measure against tsutsugamushi disease. Tr. Jap. Path. Soc. 15: 232-234, 1925.
49. Ibid.: Studies on tsutsugamushi disease. Tr. Jap. Path. Soc. 17: 243-244, 1927. (In Japanese.)
50. Ibid.: Results of the study of tsutsugamushi disease during 1932. Tr. Soc. path. jap. 23: 30-31, 1933.
51. Ibid.: Studies on tsutsugamushi disease. Report for 1932. Tr. Soc. path. jap. 23: 735-738, 1933.
52. Ibid.: Supplementary studies on tsutsugamushi disease. Tr. Soc. path. jap. 27: 596-599, 1937.

53. HAYASHI, N., and KATO, S.: Über das Vorkommen des Tsutsugamushi-Virus bei Tsutsugamushi und ihren verwandten Insekten. Tr. Soc. path. jap. 25: 100-109, 1935. (In Japanese.)
54. HAYASHI, N., and KATO, T.: Therapie und Prophylaxie der Tsutsugamushi-Krankheit. Tr. Soc. path. jap. 25: 110-113, 1935. (In Japanese.)
55. HEASLIP, W. G.: An investigation of the condition known as coastal fever in North Queensland; its separation from scrub typhus. M. J. Australia 2: 555-564, November 30, 1940.
56. Ibid.: Tsutsugamushi fever in North Queensland, Australia. M. J. Australia 1: 380-392, March 29, 1941.
57. KAPILA, C. C., and MAITRA, G. C.: A severe case of scrub typhus. Indian M. Gaz. 72: 417-418, July 1937.
- 58. KATO, T.: A new method of finding *Rickettsia tsutsugamushi* from wild mice. Tr. Soc. path. jap. 23: 738-740, 1933. (In Japanese.)
59. KATO, T.; KATO, S.; and HAYASHI, N.: Beiträge zum Studium der Tsutsugamushi-Krankheiten. Tr. Soc. path. jap. 28: 120-122, 1938. (In Japanese.)
60. KAWAHIGASHI, K.: Experiences with tsutsugamushi fever especially with the so-called atypical cases. Taiwan Igakkai Zassi 40: 355-367, February 1941. (In Japanese with German summary.)
61. KAWAMURA, R.: Studies on Tsutsugamushi Disease. Med. Bull., College of Medicine, University of Cincinnati 4: Nos. 1, 2, 1926.
62. KAWAMURA, R., et al.: Weil-Felix'sche Reaktion bei der Tsutsugamushi-Krankheit. Tr. Soc. path. jap. 22: 691-697, 1932.
63. Ibid.: The Weil-Felix reaction in tsutsugamushi disease and its relation to endemic typhus in Manchukuo and Formosa. Kitasato Arch. Exper. Med. 12: 26-57, January 1935.
64. Ibid.: Über eine Schutzmethode gegen die Tsutsugamushi-Krankheit. Tr. Soc. path. jap. 27: 600-602, 1937.
65. KAWAMURA, R., and IKEDA, K.: Ecological study of the tsutsugamushi, *Trombicula akamushi* (Brumpt). The Zoological Magazine (formerly Dōbutsugaku Zassi), Tokyo 48: 553-563, October 1936. (In Japanese with English summary.)
66. KAWAMURA, R., and IMAGAWA, Y.: Die Feststellung des Erregers bei Tsutsugamushikrankheit. Zentralbl. f. Bakt. (Abt. 1) 122: 253-261, October 1, 1931.
67. KAWAMURA, R.; IMAGAWA, Y.; and ITO, T.: Ein neues Phänomen postmortaler Proliferation der Rickettsien bei der Tsutsugamushi-Krankheit. Zentralbl. f. Bakt. (Abt. 1) 125: 304-312, August 27, 1932.
68. KAWAMURA, R.; KASAHARA, S.; TOYAMA, T.; NISHINARITA, F.; and TSUBAKI, S.: On the prevention of tsutsugamushi. Kitasato Arch. Exper. Med. 16: 93-109, May 1939.
69. KAWAMURA, R.; SHIBATA, T.; and IMAGAWA, Y.: Ein Fall von Tsutsugamushi-Krankheit nach Laboratoriumsinfektion. Zentralbl. f. Bakt. (Abt. 1) 124: 355-361, May 6, 1932.
70. KAWAMURA, R., and UEDA, M.: On the treatment of general paresis with the Pescadores strain of tsutsugamushi virus. Kitasato Arch. Exper. Med. 16: 183-196, September 1939.
71. KAWAMURA, R., and YAMAGUCHI, M.: On the adult and nymph of the akamushi. Tokyo Iji-Shinshi. Nos. 1989, 1945, September 1916. (Cited by Miyajima and Okumura, (III).)
72. Ibid.: Ueber die Tsutsugamushi-Krankheit in Formosa, zugleich eine

- vergleichende Studie derselben mit der in Nordjapan. *Kitasato Arch. Exper. Med.* 4: 169-206, September 1921.
73. KAWAMURA, R., and YAMAMIYA, C.: On the tsutsugamushi disease in the Pescadores. *Kitasato Arch. Exper. Med.* 16: 79-92, January 1939.
 74. KIMURA, R., et al.: Untersuchungen über den Erreger der Tsutsugamushi-Krankheit in den Gewebskulturen. *Tr. Soc. path. jap.* 22: 668-670, 1932.
 75. KITASHIMA, T., and MIYAJIMA, M.: Studien über die Tsutsugamushi-Krankheit. *Kitasato Arch. Exper. Med.* 2: 91-146, July 1918.
 76. Ibid.: Studien über die Tsutsugamushi-Krankheit. *Kitasato Arch. Exper. Med.* 2: 237-331, December 1918.
 77. KOUWENAAR, W.: Onderzoeken over het sumatraansche Rickettsiosen, XI. De pathologische anatomie van mijtekoorts bij den mensch. *Geneesk. tijdschr. v. Nederl.-Indië* 80: 1119-1139, April 30, 1940.
 78. Ibid.: De Nederlandsch-Indische Rickettsiosen. *Geneesk. tijdschr. v. Nederl.-Indië* 81: 41-52, January 6, 1941.
 79. KOUWENAAR, W., et al.: Onderzoekingen over mijtekoorts. *Nederl. tijdschr. v. geneesk.* 76: 4640-4647, October 1, 1932.
 80. Ibid.: Onderzoekingen over mijtekoorts. *Nederl. tijdschr. v. geneesk.* 76: 4746-4757, October 8, 1932.
 81. KOUWENAAR, W., and WOLFF, J. W.: Onderzoekingen over de sumatraansche mijtekoorts. *Nederl. tijdschr. v. geneesk.* 77: 3547-3556, August 5, 1933.
 82. Ibid.: Onderzoekingen over sumatraansche Rickettsiosen. *Geneesk. tijdschr. v. Nederl.-Indië* 74: 1659-1670, December 4, 1934.
 83. Ibid.: Onderzoekingen over sumatraansche Rickettsiosen, VIII. Infectieproeven met mijtekoortsvirus op hoogere apen. *Geneesk. tijdschr. v. Nederl.-Indië* 75: 117-123, January 22, 1935.
 84. Ibid.: Sumatranisches Milbenfieber: Eine Krankheit der Fleckfiebergruppe. *Zentralbl. f. Bakt. (Abt. 1)* 135: 427-436, January 13, 1936.
 85. Ibid.: Rickettsia infections in Sumatra. *Proc. 6th Cong. Pac. Sc. Assoc.* (1939), 5: 633-637, 1942.
 86. KURODA, O.: Experimentelle Studien über eine intrakutane Reaktion bei Tsutsugamushi-Krankheit. *Zentralbl. f. Bakt. (Abt. 1)* 136: 163-172, March 24, 1936.
 87. KUYPERS, C. A.: Een tweetal gevallen van tropical typhus? *Geneesk. tijdschr. v. Nederl.-Indië* 75: 1896-1903, October 29, 1935.
 88. LAGRANGE, E.: A propos d'un cas de pseudo-typhus en Annam. *Bull. Soc. path. exot.* 16: 105-110, February 14, 1923.
 89. LANGAN, A. M., and MATHEW, R. Y.: The establishment of "Mossman," "Coastal" and other previously unclassified fevers of North Queensland as endemic typhus. *M. J. Australia* 2: 145-148, August 3, 1935.
 90. LÉPINE, P.: Les fièvres du groupe des typhus en Indochine française. *Proc. 6th Cong. Pac. Sc. Assoc.* (1939). 5: 629-631, 1942.
 91. LEWTHWAITE, R., and SAVOOR, S. R.: Tropical typhus (rural type) and the tsutsugamushi disease as encountered in the Federated Malay States. *Far East. A. Trop. Med., Tr. Ninth Cong.*, 1934. pp. 249-257. 1935.
 92. Ibid.: Recent work on the typhus-like fevers of Malaya. *Tr. Roy. Soc. Trop. Med. and Hyg.* 29: 561-582, April 1936.

93. Ibid.: The typhus group of diseases in Malaya. Part I. The Study of the virus of rural typhus in laboratory animals. *Brit. J. Exper. Path* 17: 1-15, February 1936.
94. Ibid.: The typhus group of diseases in Malaya. Part II. The study of the virus of tsutsugamushi disease in laboratory animals. *Brit. J. Exper Path.* 17: 15-20, February 1936.
95. Ibid.: The typhus group of diseases in Malaya. Part III. The study of the virus of the urban typhus in laboratory animals. *Brit. J Exper. Path.* 17: 23-34, February 1936.
96. Ibid.: The typhus group of diseases in Malaya. Part IV. The isolation of two strains of tropical typhus from rats. *Brit. J. Exper. Path* 17: 208-213, June 1936.
97. Ibid.: The typhus group of diseases in Malaya. Part V. The Weil-Felix reaction in laboratory animals. *Brit. J. Exper. Path.* 17: 214-228, June 1936.
98. Ibid.: The typhus group of diseases in Malaya. Part VII. The relation of rural typhus to tsutsugamushi (with special references to cross-immunity tests). *Brit. J. Exper. Path.* 17: 448-460, December 1936.
99. Ibid.: The typhus group of diseases in Malaya. Part VIII. The relation of tsutsugamushi disease (including rural typhus) to urban typhus. *Brit. J. Exper. Path.* 17: 461-466, December 1936.
100. Ibid.: The typhus group of diseases in Malaya. Part IX. The relation of the tsutsugamushi disease (including rural typhus) and urban typhus to Rocky Mountain spotted fever. *Brit. J. Exper. Path.* 17: 466-472, December 1936.
101. Ibid.: Rickettsia diseases of Malaya. Identity of tsutsugamushi and rural typhus. Part I. *Lancet* 238: 255-259, February 10, 1940.
102. Ibid.: Rickettsia diseases of Malaya. Identity of tsutsugamushi and rural typhus. Part II. *Lancet* 238: 305-311, February 17, 1940.
103. LI SHIH-CHÊN: Pen Ts'ao Kang Mu (A Chinese Materia Medica of the Ming Dynasty), 1591-1592. 42nd Chuân (Chapter), p. 28. 1885 edition.
104. MACNAMARA, C. V.: An epidemic of typhus (vector unknown) in the Simla Hills. *J. Roy. Army M. Corps* 64: 174-186, March 1935.
105. MAITRA, G. C., and SEN GUPTA, P. N.: A note on cases of typhus fever in Burma and their distribution. *Indian M. Gaz.* 71: 572-574, October 1936.
106. MARTIN C. DE C., and ANDERSON, L. A. P.: A case of tropical typhus serologically related to scrub typhus of Federated Malay States. *Indian M. Gaz.* 68: 432-435, August 1933.
107. MATHEW, R. Y.: Endemic typhus in North Queensland. *M. J. Australia* 2: 371-377, September 3, 1938.
108. MATSUMOTO, T.: On tsutsugamushi disease in Middle Formosa. *Taiwan Igakkai Zassi* 303: 632-638, June 1930.
109. MEHTA, D. R.: Studies on typhus in the Simla Hills. VIII. Ectoparasites of rats and shrews with special reference to their possible role in the transmission of typhus. *Indian J. M. Research* 25: 353-365, October 1937.
110. MIYAJIMA, M.: Ueber die Aetiologie der Tsutsugamushi-Krankheit (Ueberschwemmungsfieber) in Japan. *Centralbl. f. Bakt. (Abt. 1)* 50 (Beiheft): 34-42, 1911.
111. MIYAJIMA, M., and OKUMURA, I.: On the life cycle of the "Akamushi",

- carrier of Nippon River Fever. Kitasato Arch. Exper. Med. 1: 1-14, April 1917.
112. MIYAZAWA, H., and MIYAZAWA, M.: Rickettsia orientalis in tissue culture. Tr. Jap. Path. Soc. 22: 670-680, 1932.
 113. MONTEL, R.: Cas de pseudo-typhus type Schüffner observés en Cochinchine. Fièvre Boutonneuse? Fièvre fluviale du Japon? Bull. Soc. path. exot. 29: 551-560, May 13, 1936.
 114. MORISHITA, K.: Tropical typhus. Relations between the tsutsugamushi disease and the tropical typhus and between tsutsugamushi disease and Deli fever in Malaya. Taiwan Igakkai Zassi 34: 499-515, 1935.
 115. Ibid.: Tsutsugamushi disease in Formosa. Dōbutsugaku Zassi (The Zoological Magazine) 51: 89-90, February 1939.
 116. Ibid.: Further notes on the epidemiology of tsutsugamushi disease in Formosa. Taiwan Igakkai Zassi 38: 1471-1484, September 28, 1939. (In Japanese with English summary.)
 117. Ibid.: Tsutsugamushi disease: Its epidemiology in Formosa. Proc. 6th Cong. Pac. Sc. Assoc. (1939). Epidemiology 5: 639-647, 1942.
 118. MÜHLENS, P.: Die Bedeutung des Fleckfiebers für Afrika. Deutsche tropenmed. Ztschr. 45: 248-256, April 15, 1941.
 119. NAGAYO, M.: Ueber die Tsutsugamushi-Krankheit. Tokyo Igakki Zassi (Mitteilungen der Medizinischen Gesellschaft zu Tokio) 29: 1439-1462, October 20, 1915. (In Japanese and German.)
 120. NAGAYO, M., et al.: On the adult and nymph of akamushi. Iji Shimbun, No. 956, August 1916. (In Japanese.) (Cited by Miyajima and Okumura, (III).)
 121. Ibid.: On the nymph and prosopon of the tsutsugamushi, *Leptotrombidium akamushi* n. sp. (*Trombidium akamushi* Brumpt), carrier of the tsutsugamushi disease. J. Exper. Med. 25: 255-272, February 1, 1917.
 122. Ibid.: On the species of tsutsugamushi. Tr. Jap. Path. Soc. 11: 471-473, 1921. (Japanese edition.) (Abs. Jap. J. Zool. 1: 49)
 123. Ibid.: Five species of tsutsugamushi (the carrier of Japanese river fever) and their relation to the tsutsugamushi disease. Am. J. Hygiene 1: 569-590, September-November 1921.
 124. Ibid.: Studies concerning the etiology of tsutsugamushi disease. Tr. Jap. Path. Soc. 12: 48-49, 1924.
 125. Ibid.: Demonstration of the virus of tsutsugamushi disease. Scientific Reports of the Government Institute for Infectious Diseases, Japan. 3: 37-39, 1924.
 126. Ibid.: Sur le virus de la maladie de tsutsugamushi. Compt. rend. Soc. de biol. 104: 637-641, June 20, 1930.
 127. Ibid.: Über den Nachweis des Erregers der Tsutsugamushi-Krankheit, der Rickettsia orientalis. Jap. J. Exper. Med. 9: 87-150, March 20, 1931.
 128. Ibid.: Sur le virus de la maladie dite tsutsugamushi. Bull. Office internat. d'hyg. pub. 23: 1411-1414, August 1931.
 129. NAUCK, E. G.: Epidemiologie und Tropenkrankheiten in China. Arch. f. Schiffs- u. Tropen-Hyg. 32, Beiheft 5. 83 pp. Barth, Leipzig, 1928.
 130. NICHOLLS, L.: A case of tsutsugamushi (rural typhus) in Ceylon. Brit. M. J. 2: 490, October 12, 1940.
 131. NÔC, F., and GAUTRON, P.: Deux cas de fièvre indéterminée rappelant le pseudo-typhus de Delhi observés à Saïgon. Bulletin de la Société de Médico-Chirurgicale d'Indochine. 1915: 108.

132. OGATA, M.: Vorläufige Mitteilung über die Aetiologie der Tsutsugamushi (Kedani-) Krankheit. Deutsche med. Wchnschr. 32: 1828-1830, 1868-1870, November 8, 1906.
133. OGATA, M., and ISHIWARA, K.: Zweite Mitteilung über die Aetiologie der Tsutsugamushikrankheit. Deutsche med. Wchnschr. 33: 1331-1333, August 15, 1907.
134. OGATA, N.: Aetiologie der Tsutsugamushikrankheit: *Rickettsia tsutsugamushi*. Zentralbl. f. Bakt. (Abt. 1) 122: 249-253, October 1, 1931.
135. Ibid.: Aetiologie der Tsutsugamushikrankheit. *Rickettsia tsutsugamushi*. Far East. A. Trop. Med., Tr. Eighth Cong. (1930). 2: 167-171, June 1932.
136. Ibid.: Die Tsutsugamushi-Krankheit. "*Rickettsia tsutsugamushi*." Arch. f. Schiffs- u. Tropen-Hyg. 39: 491-505, December 1935.
137. Ibid.: Studies of the virus of Tsutsugamushi disease, *Rickettsia tsutsugamushi*. Tr. Jap. Path. Soc. 25: 87-100, 1935. (In Japanese.)
138. Ibid.: Der Erreger der Tsutsugamushi-Krankheit-*Rickettsia tsutsugamushi*. Tr. Soc. path. jap. 27: 591-595. (In Japanese.)
139. OOMEN: Typhusachtige koortsen in de practijk. In Verslagen der afdeulingsvergaderingen. II- Afdeeling Minahassa (p. 99.) Geneesk. tijdschr. v. Nederl.-Indië 81: 91-103, January 13, 1941.
140. PALM, T. A.: Some account of a disease called "Shima-mushi" or "Island-Insect Disease" by the natives of Japan; peculiar it is believed to that country and hitherto not described. Edinburgh M. J. 24: 129-132, 1878.
141. Philip, C. B.: Nomenclature of the pathogenic rickettsiae. Am. J. Hyg. 37: 301-309, May 1943.
142. PINKERTON, H.: Pathogenic Rickettsiae with particular reference to their nature, biologic properties and classifications. Bact. Rev. 6: 37-38, March 1942.
143. RAGIOT, C., et al.: Note au sujet des typhus dites "tropicaux" observés in Indochine méridionale. Bull. Soc. path. exot. 31: 460-461, June 8, 1938.
144. RAGIOT, C., and DELBOVE, P.: Typhus endémique et typhus tropical en Cochinchine. Bull. Soc. path. exot. 28: 163-167, March 13, 1935.
145. Ibid.: Typhus endémique de Cochinchine. Far East. A. Trop. Med., Tr. Ninth Cong. (1934). 2: 471-479, 1935.
146. Ibid.: Les fièvres exanthématiques du type "tsutsugamushi" en Indochine méridionale. Proc. 6th Cong. Pac. Sc. Assoc. (1939). 5: 623-627, 1942.
147. RAYNAL, J. H.: Le typhus murin à Chang-Hai. Bull. Soc. path. exot. 33: 168-175, March 13, 1940.
148. REYNES, V., and RICHARD, J.: Sur un cas de typhus tropical avec réactions de Bordet-Wassermann transitoirement positives. Bull. Soc. path. exot. 33: 363-366, June 12, 1940.
149. SAMBON, L. W.: The parasitic acarids of animals and the part they play in the causation of eruptive fevers and other diseases of man. Preliminary considerations based upon an ecological study of typhus fever. Ann. Trop. Med. 22: 67-142, June 12, 1928.
150. SCHÜFFNER, W.: Pseudotyphoid fever in Deli, Sumatra. Philippine J. Sc. (Sec. B.) 10: 345-353, September 1915.
151. Ibid.: Nederl. vereeniging voor tropische geneeskunde. (Zondag 18 Januari 1931) Neder. tijdschr. v. geneesk. 75: 2897-2909, May 30, 1931.

152. SCHÜFFNER, W., and WACHSMUTH, M.: Ueber eine typhusartige Erkrankung (Pseudotyphus of Deli). Ztschr. f. klin. Med. 71: 133-156, 1910.
153. Ibid.: A disease resembling typhoid fever in Deli, Sumatra, "Pseudotyphoid Fever." Tr. Bombay Med. Cong., 1909. pp. 55-56, 1910.
154. SELLARDS, A. W.: The cultivation of a rickettsia-like micro-organism from tsutsu-gamushi disease. Am. J. Trop. Med. 3: 529-547, November 1923.
155. SINCLAIR, B. A.: A possible case of tsutsugamushi or Japanese river fever occurring in the Mandated territory of New Guinea. M. J. Australia 2: 759, December 6, 1930.
156. SMITH, R. O. A., and MEHTA, D. R.: Studies on typhus in the Simla Hills. VII. Attempts to isolate a strain of XK typhus from wild rats. Indian J. M. Research 25: 345-351, October 1937.
157. SMITHSON, O.: Mossman fever. Am. J. Trop. Med. 13: 351-352, December 1, 1910.
158. SOUCHARD, L., et al.: Étude expérimentale d' un virus exanthématique isolé d' un cas de typhus, présentant la symptomatologie de la fièvre fluviale du Japon. Bull. Soc. path. exot. 24: 678-708, October 14, 1931.
159. SOUCHARD, L., and TOURNIER: Un nouveau cas de typhus exanthématique, type fièvre fluviale observé en Indochine. Bull. Soc. path. exot. 30: 257-261, April 14, 1937.
160. SUBRAHMANYAM, C.: Tropical typhus in Singapore. Tr. Roy. Soc. Trop. Med. and Hyg. 30: 263-268, July 1936.
161. SURBEK, K. E.: Casuistische mededeelingen. Geneesk. tijdschr. v. Nederl.-Indië 71: 734-736, July 1931.
162. TANAKA, K.: Ueber Aetiologie und Pathogenese der Kedani-Krankheit. Centralbl. f. Bakt. (Abt. 1) 26: 432-439, October 28, 1899.
163. Ibid.: Ueber meine japanische Kedani-Krankheit. Centralbl. f. Bakt. (Abt. 1) 42: 16-18, August 15, 1906; 42: 104-108, September 1, 1906; 42: 235-240, September 18, 1906; 42: 329-334, October 1, 1906.
164. Ibid.: Sind die japanischen Rickettsien die Erreger der Kedani- (Tsutsugamushi-) Krankheit? Zentralbl. f. Bakt. (Abt. 1) 129: 490-492, October 6, 1933.
165. TANAKA, K.; KAIWA, J.; TERAMURA, S.; and KAGAYA, J.: Beiträge zur japanischen Kedani-Krankheit. Zentralbl. f. Bakt. (Abt. 1) 116: 353-385, May 15, 1930.
166. UNWIN, M. L.: "Coastal fever" and endemic tropical typhus in North Queensland; recent investigation, clinical and laboratory findings. M. J. Australia 2: 303-308, September 7, 1935.
167. VAUCÉL, M., and BRUNEAU, M.: Isolement, des rats de Hanoi, d'une souche de *Proteus* OXK. Bull. Soc. path. exot. 30: 448-450, June 9, 1937.
168. van der SCHROEFF, J. P.: Een epidemie van mijtekoorts en tropical typhus in Atjeh en onderhoorigheden. Geneesk. tijdschr. v. Nederl.-Indië 81: 1103-1122, May 20, 1941.
169. van STEENIS, P. B.: Een geval van pseudo-typhus (Schüffner) op Java met enkele opmerkingen over de differentieele diagnostiek in de groep der febris exanthematica. Nederl. tijdschr. v. geneesk. 75: 495-502, January 31, 1931.
170. van WAARDENBURG, D. A.: Over een geval van tropical typhus en een geval van mijtekoorts in de Resedentie Benkoelen. Geneesk. tijdschr. Nederl.-Indië 75: 878-892, May 28, 1935.
171. VIELLE, E., and SOUCHARD, L.: Sur un cas de typhus exanthématique

- observé en Cochinchine. Bull. Soc. path. exot. 24: 302-310, April 15, 1931.
172. von der BORCH, R.: Non-epidemic typhus; a report on 14 cases occurring on goldfields, Wau, mandated territory of New Guinea between January 1, 1935, and June 30, 1936. M. J. Australia 1: 435-439, March 20, 1937.
173. WALCH, E. W.: Over *Trombicula deliensis* n. sp. vermoedelijke overbrengster des pseudo-typhus en andere *Trombicula* van Deli. Geneesk. tijdschr. v. Nederl.-Indië 62: 531-588, 1922.
174. Ibid.: On *Trombicula deliensis*, probably carrier of pseudo-typhus and on other *Trombicula* species of Deli. Kitasato Arch. Exper. Med. 5: 63-83, February 1923.
175. Ibid.: On pseudo-typhus of Sumatra. Far East. A. Trop. Med., Tr. Fifth Cong., (1923). pp. 583-627, 1924.
176. Ibid.: Over de *Trombiculae*, welke de pseudo-typhus overbrengen, en na verwante mijten uit Deli, (2^e mededeeling). Geneesk. tijdschr. v. Nederl.-Indië 64: 499-528, 1924.
177. Ibid.: On the *Trombiculae*, carriers of pseudo-typhus and related species from Sumatra. Kitasato Arch. Exper. Med. 6: 235-257, June 1925.
178. Ibid.: Nederlandsch-Indië *Trombiculae* en verwante mijten. Geneesk. tijdschr. v. Nederl.-Indië 67: 922-933, 1927.
179. WALCH, E. W., and KEUKENSCHRIJVER, N. C.: Eenige opmerkingen aangaande de epidemiologie van de pseudo-typhus. Geneesk. tijdschr. v. Nederl.-Indië 64: 247-276, 1924.
180. Ibid.: On pseudo-typhus of Sumatra. Far East. A. Trop. Med., Tr. Fifth Cong., (1923). pp. 627-643, 1924.
181. WEIR, H. H.: A continued fever of Korea. St. Bartholomew's Hosp. J. 22: 144-147, July 1915.
182. Ibid.: A continued fever of Korea. China M. J. 29: 307-315, September 1915.
183. WHEATLAND, F. T.: Some notes on unclassified fevers occurring in the North Queensland Coastal Regions. M. J. Australia (supp.) 1: 322, May 17, 1924.
184. WOLFF, J. W.: "Tropical typhus," een vlektyphus-achtige ziekte. Geneesk. tijdschr. v. Nederl.-Indië 69: 429-461, May 10, 1929.
185. Ibid.: Observations on the Weil-Felix reaction in tsutsugamushi disease. J. Hyg. 31: 352-360, July 1931.
186. Ibid.: Qualitative protens- -X- agglutinatie bij. mijtekoorts en tropical typhus. Geneesk. tijdschr. v. Nederl.-Indië 72: 896-914, July 5, 1932.
187. WOLFF, J. W., and de GRAAF, W.: Twee nieuwe gevallen van mijtekoorts op Java. Geneesk. tijdschr. v. Nederl.-Indië 79: 2434-2441, September 26, 1939.
188. Ibid.: Twee nieuwe gevallen van mijtekoorts op Java. Geneesk. tijdschr. v. Nederl.-Indië 79: 2527-2531, October 3, 1939.
189. Ibid.: Twee nieuwe gevallen van mijtekoorts op Java. Geneesk. tijdschr. v. Nederl.-Indië 79: 2577-2587, October 10, 1939.
190. WOLFF, J. W., and KOUWENAAR, W.: Onderzoekingen over mijtekoorts. Nederl. tijdschr. v. geneesk. 77: 269-279, January 21, 1933.
191. Ibid.: Onderzoekingen over de sumatraansche mijtekoorts. Geneesk. tijdschr. v. Nederl.-Indië 74: 1608-1618, November 20, 1934.
192. Ibid.: Onderzoekingen over de sumatraansche mijtekoorts, IX. Oogeninfecties bij. konijen. Geneesk. tijdschr. v. Nederl.-Indië 75: 805-810, May 14, 1935.

193. Ibid.: Onderzoeken over sumatraansche Rickettsiosen. *Geneesk. tijdschr. v. Nederl.-Indië* 76: 272-288, February 4, 1936.
194. WOODHEAD, L. S. F., and DUTTA, U. C.: A note of fevers of typhus group in Assam. *Indian M. Gaz.* 76: 406-407, July 1941.
195. YAMAMIYA, C.: On the tsutsugamushi disease in the Pescadores. *Sain-gaku Zassi*. No. 469-470, 1935. (In Japanese.) Cited by Kawamura and Yamamiya, (73).
196. YERSIN, A., and VASSAL, J. J.: Typhus fever in Indochina. *Philippine J. Sc. (Sec. B.)* 3: 130-149, January 1908.
197. Ibid.: Une maladie rappelant le typhus exanthématique observé en Indo-chine. *Bull. Soc. path. exot.* 1: 156-164, March 11, 1908.
198. YOSHIDA, S.: Tissue culture of tsutsugamushi virus (*Rickettsia tsutsugamushi*). *Kitasato Arch. Exper. Med.* 12: 324-337, October 1935.
199. Jaarverslag van den Dienst der Volksgezondheid over 1934 (p. 413 Reactie van Weil-Felix). *Mededeel. v. d. dienst. d. volksgezondh. in Nederl.-Indië* 24: 404-460, 1935.
200. NICOLLE, C., and SPARROW, H.: Quelques expériences pratiques avec le virus de la fièvre fluviale du Japon (*tsutsugamushi*). *Arch. Inst. Past. Tunis* 24: 179-218.
201. LEWTHWAITE, R., and SAVOOR, S. R.: Role of *Xenopsylla cheopis* in transmission of "K" type typhus. *Ann. Rep. Inst. Med. Res. Fed. Malay States (1935)*: 35-54.

ADDENDUM:—Other arthropods have been suggested as possible vectors of *tsutsugamushi*. Several authors have indicated the possibility of tick transmission. Schüffner (150) suggested it on the basis of finding an amblyommid larva attached to a primary eschar. Kouwenaar and Wolff (82) (85) reported infected specimens of *Dermacentor auratus* Supino collected from wild hogs. In India also ticks have been suspected as transmitters of *tsutsugamushi* disease. For instance, Mehta (109) considered *Hyalomma aegyptium* (L.) as a possible vector. Flea transmission has been suggested by Nicolle and Sparrow (200) in Indochina and by Lewthwaite and Savoor (201) in Malaya based on experimental transmissions among laboratory animals by *Xenopsylla cheopis* Rothschild.

ACKNOWLEDGEMENT.—The authors gratefully acknowledge the assistance of several individuals in the preparation of this paper. Dr. Tsai-Yu Hsiao has translated the Chinese references and many of the Japanese papers. Dr. H. E. Ewing, Division of Insect Identification, U. S. Department of Agriculture, has assisted in preparing the material on the life cycle of *Trombicula akamushi* and has critically examined the entire manuscript. Dr. Remington Kellogg, Curator of Mammals, U. S. National Museum, has examined the parts dealing with the mammalian hosts of the rickettsia and the mite larvae. The map was prepared by Chief Pharmacist John A. McCalley (HC) USN. The authors are further indebted to Comdr. Van C. Tipton (MC) USNR, Comdr. James J. Saperio (MC) USN, Lt. Col. Joseph S. Sadusk (MC) AUS, and Lt. Comdr. Dean F. Smiley (MC) USNR, for their critical readings of the manuscript and their suggestions. The preparation of this paper was originally suggested by Capt. T. J. Carter (MC) USN; through his interest and encouragement its completion has been possible.

NOTE ON TAXONOMY OF TYPE SPECIES OF THE MITE GENUS *TROMBICULA* BERLESE¹

H. E. EWING²

The mite genus *Trombicula* was established in 1905 by Berlese, based on *Trombicula minor* Berlese, a species occurring in Java. Because of certain statements made by Berlese (1) (2) in the two descriptions he gave of this species, certain entomologists, including myself, have held the opinion that the specimens from which the descriptions were made were nymphs instead of adults. Particularly was this conclusion held justified because of their small size (length 680 μ , according to Berlese) and because Berlese represented the palpal tibia as having only two subterminal spines instead of the three or four usually present in adults.

The fact that the larval stage of *T. minor* was not known added to the confusion regarding this type species, since most of the trombiculid mites are known only in the larval stage and the generic, as well as the specific, characters are those of the larvae.

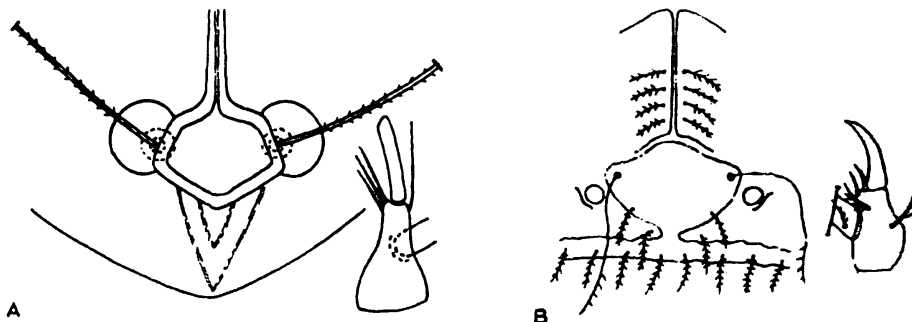
Gunther (3) reported the rearing of several nymphs from the larvae of *Trombicula hirsti* var. *buloloensis* Gunther taken in the Morobe District of New Guinea. These he has claimed represent the nymphs of *Trombicula minor* Berlese, apparently following the conclusions of Womersley who checked his material.

But Willmann (4) has reexamined the types of *T. minor* which were deposited at the Zoological Museum in Hamburg, Germany, and discovered that the two specimens were adults, one being a female with a fully formed egg in the grip of the genital suckers. He also discovered that Berlese had been in error in certain respects in his descriptions and figures of *T. minor*. Particularly was this true in regard to the subterminal spines of the palpal tibia. Instead of there being two of these which differed greatly in thickness, Willmann found that there were three, of about equal thickness, this number being the proper one for adults.

In order that a comparison may be made between Gunther's drawings of his reared nymphs of *Trombicula hirsti* var. *buloloensis*

¹ This note has been prepared in order to clarify the nomenclature of *Trombicula hirsti* Sambon of New Guinea as used in "Tsutsugamushi Disease" by Lieutenant, junior grade, Donald S. Farner H-V(S) U.S.N.R., and Lieutenant, junior grade, Chris P. Katsampes (MC) U.S.N.R., page 800 in this issue of the BULLETIN.

² Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture.



A. Area sensilligera and palpal tibia of *Trombicula minor* Berlese (after Willmann). **B.** Area sensilligera and palpal tibia of reared nymph of *Trombicula hirsti* var. *buloloensis* Gunther (after Gunther).

loensis and the new drawings of Willmann of the types of *T. minor* both are given here for comparison.

The type specimens of *T. minor* had, according to Willmann, the following data: "Tjompea, Java, 19-III-1904, sifted from cave guano." Because of this peculiar habitat, Willmann was of the opinion that bats were probably the hosts of the larvae of *T. minor*.

In view of Willmann's restudy of the types of *T. minor* it appears the following conclusions may be drawn:

1. *Trombicula minor* Berlese is a very small species, the adults of which are of about the same size as the nymphs of such species as *Trombicula akamushi* (Brumpt) and *Trombicula deliensis* Walch.

2. The species is peculiar in that the pseudostigmata are very large, the palpal claw is but slightly tapering apically, and the subterminal spines of the palpal tibia are almost setiform, long, set adjacent to each other, and subparallel.

3. Being found in cave guano, the inference is strong that the larvae of *T. minor* have bats as hosts.

4. Because of these facts it appears to the writer that *Trombicula hirsti* Sambon is a species distinct from *T. minor* Berlese.

REFERENCES

1. BERLESE, A.: *Acari Nuovi. Manipulus IV (Acari di Giava)*. Redia 2: 155-156, 1905.
2. Ibid.: *Trombidiidae*. Redia 8: 1-291, 1912.

3. GUNTHER, C. E. M.: The association between the larva described as *Trombicula hirsti* var. *buloloensis* Gunther 1939, and *Trombicula minor* Berlese 1904. Proc. Linn. Soc. N. S. Wales 64: 285-286, 1939.
4. WILLMANN, C.: *Trombicula minor* Berlese 1905, Typenart der Gattung *Trombicula* Berlese. Zool. Anz. 133: 131-136, 1941.



STATISTICS

HEALTH OF THE NAVY

The statistics for the second quarter of 1944, scheduled to appear in this issue of the BULLETIN, will be published in the December issue. It has been deemed advisable to lengthen the time period between receipt of reports from the field and preparation in the Bureau of the final data for publication in the BULLETIN, in order to present a more complete statistical tabulation.

NOTES ON OUR RESERVE CONTRIBUTORS

Banzer, John W., Jr., Lieutenant, junior grade (MC) USNR (*Dermatitis from Blue Uniforms*, p. 754). LL.M., Saint Lawrence University, 1937; M.D., Georgetown University School of Medicine, 1943. Intern, Queens General Hospital, Jamaica, N. Y., 1943-44.

Barnes, LaVerne A., Lieutenant Commander H-V(S) USNR (*Pathogenic Enteric Bacilli*, p. 707). B.S., 1925; M.S., 1928; Ph.D., 1929, State College of Washington. Demonstrator in bacteriology, Western Reserve School of Medicine, 1925-26; teaching fellow in bacteriology, State College of Washington, 1926-29; senior instructor in bacteriology, Western Reserve School of Medicine, 1929-31; senior bacteriologist, Massachusetts Department of Public Health, 1931-; assistant in preventive medicine, Harvard Medical School and School of Public Health, 1931-. Fellow American Public Health Association; member: Society of American Bacteriologists; American Association of Immunologists; Massachusetts Public Health Association. Coauthor, *Biology of Pneumococcus*, Commonwealth Fund, 1938.

Braceland, Francis J., Commander (MC) USNR (*Role of the Psychiatrist in the General Rehabilitation Program*, p. 621). A.B., La Salle College, 1926; M.D., Jefferson Medical College of Philadelphia, 1930; Sc.D., La Salle College, 1940. Intern, Jefferson Hospital, Philadelphia, 1930-32; resident, Pennsylvania Hospital, Department for Nervous and Mental Diseases, Philadelphia, 1932-35; Rockefeller Fellow in Psychiatry; Burgholzli Anstalt, Zurich, Switzerland, 1935; National Hospital, Queens Square, London, 1936; clinical director, Pennsylvania Hospital for Nervous and Mental Diseases, 1937; private practice in psychiatry, Philadelphia, 1937-40; consulting psychiatrist: Pennsylvania Hospital; St. Joseph's Hospital; Misericordia Hospital; Mercy-Fitzgerald Hospital; Babies' Hospital, Philadelphia, 1937-40; assistant professor of psychiatry, Graduate School, University of Pennsylvania, 1938; associate professor of psychiatry, Womens Medical College, 1938-41; dean of School of Medicine and clinical professor of psychiatry, Loyola University, 1941-. Fellow: American Medical Association; American College of Physicians; Philadelphia College of Physicians; American Psychiatric Association; member: Philadelphia Psychiatric Society; Chicago Institute of Medicine; American Society for Research in Psychosomatic Medicine; Association for Research in Nervous and Mental Diseases; Central Neuropsychiatric Association. Diplomate American Board of Psychiatry and Neurology.

Bruce, Norman H., Lieutenant (MC) USNR (*Primary Axillary Vein Thrombosis*, p. 748). M.D., Harvard Medical School, 1934. Intern, Boston City Hospital, 1935-37; resident; Boston Sanatorium, 1937; Pondville Hospital, Walpole, Mass., 1937-40; assistant in surgery, out-patient department, Massachusetts General Hospital, 1940-; visiting surgeon, Waltham Hospital, Waltham, Mass., 1940-; Newton Hospital, Newton, Mass., 1940-; Tumor Clinic, Boston Dispensary, 1940-42. Fellow, American Medical Association; member Massachusetts Medical Society.

Brunnstrom, Signe, Lieutenant, junior grade W-V(S) (H) USNR (*Physical Therapy in Aftercare of Amputations of Lower Extremity*, p. 634). B.S., Uppsala College, Uppsala, Sweden, 1917; graduate, Royal Gymnastic Institute, Stockholm, Sweden, 1919; M.A., New York University, New York City, 1935. Physical therapist, Schweizerische Unfallversicherungs Anstalt, Lucerne, Switzerland, 1921-28; physical therapist and instructor in physical therapy, Hospital for Special Surgery, New York City, 1928-38; instructor in physical therapy, New York University, 1938-42; instructor in physical education, Metropolitan Life Insurance Company, New York City, 1929-42; physical therapy technician, Army U. S., 1942-43; physical therapy officer, U. S. Naval Hospital, Mare Island, Calif., 1943-. Member: American Physiotherapy Association; American Registry of Physical Therapy Technicians.

Carpenter, Cedric C., Lieutenant Commander (MC) USNR (*Dermatitis from Blue Uniforms*, p. 754). M.D., George Washington University School of Medicine, 1928. Intern, Garfield Memorial Hospital, Washington, D. C., 1928-29; resident, Scripps Metabolic Clinic, La Jolla, Calif., 1930; house physician, New York Skin and Cancer Hospital, New York, N. Y., 1931-32; private practice, Summit Medical Group, Summit, N. J., 1932-43; attending dermatologist, Overlook Hospital, Summit. Fellow: American Academy of Dermatology; American Medical Association; member: Investigative Dermatologic Society; North New Jersey Dermatological Society (vice president); Union County Medical Society; State Medical Society of New Jersey. Diplomate American Board of Dermatology.

Cohen, Robert A., Lieutenant Commander (MC) USNR (*A Program for the Rehabilitation of Psychiatric War Casualties*, p. 628). B.S., 1930, and Ph.D., University of Chicago; M.D., School of Medicine, University of Chicago, 1935. Assistant in physiology, University of Chicago, 1931-35; intern, Michael Reese Hospital, Chicago, Jan. 1936-July 1937; house officer, psychiatric service, Johns Hopkins Hospital, Sept. 1937-Sept. 1938; assistant in psychiatry, Johns Hopkins University, Sept. 1937-Sept. 1938; resident physician, Sheppard and Enoch Pratt Hospital, Towson, Md., Sept. 1938-Aug. 1939; fellow in psychiatry, Institute for Juvenile Research, Sept. 1939-Sept. 1940; assistant physician, Sheppard and Enoch Pratt Hospital, Towson, Md., Sept. 1940-Sept. 1941; conducted mental hygiene clinics in Kent and Cecil Counties for the Bureau of Child Hygiene, Dept. of Health, Baltimore, Md., Sept. 1940-. Member: Maryland Neurological and Psychiatric Society; American Psychiatric Association. Diplomate American Board of Neurology and Psychiatry.

Dement, Donald E., Commander (MC) USNR (*Mobile Surgical Unit Setup*, p. 773). B.A., 1920, and M.A., 1922, University of California; M.D.; University of Michigan Medical School, 1924. Intern, U. S. Naval Hospital, Mare Island, Calif., 1924-25; private practice: Hollywood, Calif., 1927-37; Bangor, Me., 1937-; staff, venereal disease department, Los Angeles County Health Department; dermatologist, Marion Davies Clinic, Children's Hospital; Hollywood Hospital, Hollywood, Calif. Fellow American Medical Association; Los Angeles County Medical Society.

Doran, Robert E., Lieutenant Commander (MC) USNR (*Fatigue-Stress Fractures*, p. 674). B.S., Hobart College, 1922; M.D., Syracuse University College of Medicine, 1926. Intern, 1926-28, resident orthopedist, 1928-30, and associate in orthopedics and assistant chief surgeon, 1930-32, Medical

Center of Jersey City, Jersey City, N. J.; attending surgeon: Geneva General Hospital, Geneva, N. Y., 1932-; Willard State Hospital, Willard, N. Y. Fellow: American Medical Association; American College of Surgeons.

Downing, F. Harold, Commander (MC) USNR (*Collapse of Intervertebral Disc Following Spinal Puncture*, p. 666). A.B., Stanford University, 1925; M.D., Stanford University School of Medicine, 1929. Intern, Highland-Alameda County Hospital, Oakland, 1928-29; private practice, Oakland, Calif., 1929-31; resident, Hospital for Special Surgery (formerly Hospital for Ruptured and Crippled), New York, N. Y., 1931-33; assistant resident, Medical Center of Jersey City, Jersey City, N. J., 1933-34; resident, Hospital and Home for Crippled Children, Newark, N. J., 1934-35; private practice, Boston, Mass., 1935-37; staff: Massachusetts General Hospital, Cambridge Hospital and Long Island Hospital, Boston, 1935-37; Burnett Sanitarium, and St. Agnes Hospital, Fresno, Calif., 1937-42; private practice, Fresno, Calif., 1937-42. Diplomate American Board of Orthopedic Surgery.

Dynes, John B., Lieutenant Commander (MC) USNR (*A Program for the Rehabilitation of Psychiatric War Casualties*, p. 628). B.A., 1926, and M.A., 1930, University of Wisconsin; M.D., Harvard Medical School, 1932. Intern, Evanston Hospital, Evanston, Ill., 1932-33; resident: Eitel Hospital, Minneapolis, Minn., 1933-34; Neurological Institute of New York, 1934-36; senior psychiatrist, Boston Psychopathic Hospital, 1936-38; faculty member, psychiatry, Harvard Medical School, 1936-38 and 1939-42; Harvard traveling fellowship, abroad, 1938-39; neuropsychiatrist, Lahey Clinic, Boston, 1939-42. Diplomate American Board of Psychiatry and Neurology.

Farner, Donald S., Lieutenant, junior grade H-V(S) USNR (*Tsutsugamushi Disease*, p. 800). B.S., Hamline University, 1937; M.A., 1939, Ph.D., 1941, University of Wisconsin, assistant in zoology, 1937-41, instructor in zoology, 1941-, University of Wisconsin; temporary naturalist and aquatic biologist, National Park Service, 1939-41; biologist, Kraft Waste Disposal Committee, 1942-43. Member: American Association for the Advancement of Science; Wisconsin Academy of Science; American Society of Zoologists; American Ornithologists' Union; American Society of Parasitologists.

Ferguson, L. Kraeer, Captain (MC) USNR (*Anesthesia Aboard a Hospital Ship in Combat Areas*, p. 697). M.D., University of Pennsylvania School of Medicine, 1923. Fellow in surgery, Hospital of the University of Pennsylvania, 1923-25; year's study in Europe, 1928-29. Private practice, Philadelphia, 1925-; assistant surgeon, Hospital of the University of Pennsylvania, Philadelphia; assistant professor of surgery, University of Pennsylvania School of Medicine; surgeon, Student Health Service, University of Pennsylvania; chief of the proctologic clinic, Hospital of the University of Pennsylvania and Philadelphia General Hospital; proctologist, Policemen and Firemen of Philadelphia; chief of the industrial clinic, Hospital of the University of Pennsylvania. Fellow: American College of Surgeons; American Medical Association; member: Philadelphia Academy of Surgery; American Surgical Association; American Gastro-Enterological Association; Physiological Society, Philadelphia; American Society for Experimental Pathology. Diplomate American Board of Surgery. Author, *Surgery of the Ambulatory Patient*, 1942; coauthor, *Surgical Nursing*, 6th edition, 1940; surgical editor, *Digest of Treatment*.

Fishman, Jack, Lieutenant (MC) USNR (*Systemic Blastomycosis*, p. 758). B.A., Syracuse University, 1932; M.D., New York Medical College, Flower and Fifth Avenue Hospitals, 1933. Intern, July 1933–July 1935, and resident in obstetrics and gynecology, July 1935–July 1936, Metropolitan Hospital, Welfare Island, New York City; instructor in gynecology, 1935–36, and instructor in anatomy, 1936–42, New York Medical College, Flower and Fifth Avenue Hospitals; private practice, New York City, Jan. 1937–; clinical assistant surgeon, Sydenham Hospital, New York City, 1937–42; assistant adjunct surgeon, Beth David Hospital, New York City, 1937–. Member: New York County Medical Society; Medical Society of the State of New York.

Gershon-Cohen, J., Lieutenant Commander (MC) USNR (*Fatigue-Stress Fractures*, p. 674). M.D., University of Pennsylvania School of Medicine, 1924; D.Sc. (Medicine) Graduate School of Medicine, University of Pennsylvania, 1929. Intern, Jewish Hospital, Philadelphia, 1924–25; associate in radiology, Graduate School of Medicine, University of Pennsylvania, 1929–32; assistant radiologist, Graduate Hospital of the University of Pennsylvania, 1928–33; radiologist: Skin and Cancer Hospital, Philadelphia, 1929–; Newcomb Hospital, Vineland, N. J., 1931–; Millville Hospital, Millville, N. J., 1932–; Eagleville Sanatorium for Consumptives, Eagleville, Pa., 1930–; Phoenixville Hospital, Phoenixville, Pa., 1936–; consulting radiologist, Chester County Hospital, West Chester, Pa., 1940–; assistant professor of radiology, Graduate School of Medicine, University of Pennsylvania, 1941–. Fellow: American Medical Association; American College of Radiology; Philadelphia College of Physicians; member: American Roentgen Ray Society; Radiological Society of North America; Pan American Medical Association. Diplomate American Board of Radiology.

Goldman, Alfred, Lieutenant Commander (MC) USNR (*Aerial Evacuation of Wounded*, p. 685). A.B., University of California, 1929; M.D., University of California Medical School, 1933. Intern, University of California Hospital, San Francisco, 1932; resident: Mt. Zion Hospital, San Francisco, 1933; University of California Hospital, 1934–35; Mt. Sinai Hospital, New York City, 1935–36; Metropolitan Hospital, Welfare Island, New York City; Massachusetts General Hospital, 1936–37; clinical instructor, surgery, University of California, 1937–42; assistant visiting surgeon, San Francisco Hospital, 1937–42. Fellow American Medical Association; member: American Association for Thoracic Surgery; American Trudeau Society; San Francisco County Medical Society; American College of Chest Physicians.

Hamilton, Francis J., Lieutenant Commander (MC) USNR (*A Program for the Rehabilitation of Psychiatric War Casualties*, p. 628). A.B., St. Joseph's College, Philadelphia, 1928; M.D., Jefferson Medical College, 1933. Intern, Misericordia Hospital, Philadelphia, 1933–34; resident and chief resident in medical neurology at Neurological Institute of New York, 1935–38; junior, assistant, and resident psychiatrist at Payne Whitney Psychiatric Clinic, New York Hospital, 1938–42; instructor in psychiatry at Cornell University Medical School. Fellow American Medical Association; member New York City, County, and State Medical Societies. Diplomate American Board of Psychiatry and Neurology.

Harris, Daniel H., Lieutenant H-V(S) USNR (*Low Incidence of Malingering Among Navy Draftees*, p. 737). A.B., Columbia College, 1927; M.A., 1928,

and Ph.D., 1931, Columbia University. Instructor in psychology. Lehigh University, 1930-35; educational adviser, C.C.C. Camps, second corps area, 1935-36; psychologist, Lewisburg Federal Penitentiary, 1936-37; instructor in psychology, College of the City of New York, summers of 1936, 1937; consulting psychologist and vocational counselor, New York City, 1937-; vocational adviser, Greater New York Coordinating Committee for German Refugees, 1938-39; psychologist, New York University College of Medicine Clinic, 1938-40. Member: American Psychological Association; American Association for Applied Psychology; Society for Psychological Study of Social Issues; National Vocational Guidance Association. Qualified psychologist, New York State Department of Mental Hygiene.

Jones, John P., Lieutenant (MC) USNR (*Cold Hemagglutinins in Infectious Mononucleosis*, p. 717). M.D., Medical College of Virginia, 1937. Intern: Hospital Division, Medical College of Virginia, 1937-38; Children's Medical Service, Bellevue Hospital, New York City, July 1938-Oct. 1939; private practice, Richmond, Va., 1939-42; staff: Grace Hospital; Retreat for the Sick; Sheltering Arms Hospital, Richmond. Member: Richmond Academy of Medicine; Medical Society of Virginia; Richmond Pediatric Society; Virginia Pediatric Society.

Katsampes, Chris P., Lieutenant, junior grade (MC) USNR (*Tsutsugamushi Disease*, p. 800). B.S., Cornell University, 1931; M.D., University of Rochester School of Medicine and Dentistry, 1936; intern in pediatrics, 1936-37, assistant resident in pediatrics, 1937-38, fellow in pediatrics, 1938-39, and resident in pediatrics, 1939-40, Strong Memorial Hospital, Rochester, N. Y.; instructor in pediatrics, University of Rochester School of Medicine and Dentistry, 1940-43.

LeFevre, Ira D., Jr., Lieutenant (MC) USNR (*Yaws Survey on Nanumea Atoll*, p. 739). A.B., Hamilton College, 1936; M.D., Yale University School of Medicine, 1940. Intern, Kings County Hospital, Brooklyn, N. Y., July 1940-Jan. 1942.

Marshall, James M., Lieutenant Commander (MC) USNR (*Spontaneous Rupture of the Malarial Spleen*, p. 743). A.B., University of Utah, 1922; M.D., University of Pennsylvania School of Medicine, 1925; M.S. (Surgery), University of Minnesota Medical School, 1930. Assistant surgeon, United States Public Health Service, 1925-26; fellow in surgery, University of Minnesota (Mayo Foundation), 1927-31; attending surgeon: Collis P. and Howard Huntington Memorial Hospital; St. Luke Hospital, Pasadena, Calif. Fellow: American College of Surgeons; American Medical Association; member Los Angeles Surgical Association. Diplomate American Board of Surgery.

McDaniel, Walter S., Lieutenant Commander (MC) USNR (*Epidemic Diaphragmatic Pleurodynia*, p. 664). M.D., Texas University, 1931. Intern, Hospital of the University of Pennsylvania, 1931-33; resident, internal medicine, Kings County Hospital, Brooklyn, N. Y., 1933-35; private practice, internal medicine, Houston, Texas, 1935-41; staff: Jefferson Davis Hospital; Houston Tuberculosis Hospital, Houston, Texas. Fellow: American College of Physicians; American Medical Association; American College of Chest Physicians; member: Harris County Medical Society; Texas State Medical Association; American Diabetic Association. Diplomate American Board of Internal Medicine.

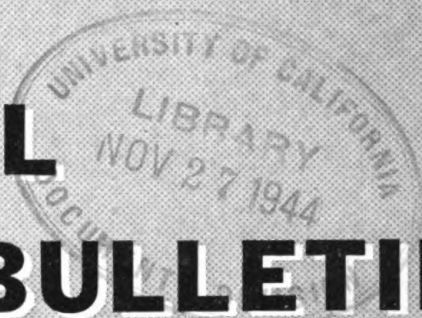
- McDermott, Kenneth F.**, Lieutenant (MC) USNR (*Yaws Survey on Nanumea Atoll*, p. 739). A.B., Municipal University of Omaha, 1931; M.D., University of Nebraska College of Medicine, 1935. Intern, Douglas County Hospital, Omaha, Nebr., 1935-36; private practice: Fullerton, Nebr., 1936-39; Grand Island, Nebr., 1939-42; surgeon, Union Pacific Railway Co., Grand Island, Oct. 1941-Oct. 1942; staff, St. Francis Hospital; Grand Island Lutheran Hospital, Grand Island, 1936-. Fellow American Medical Association; junior member American College of Surgeons; member: Nebraska State Medical Association; Hall County Medical Society.
- McLaughlin, Robert R. M.**, Lieutenant Commander (MC) USNR (*Psoriasis Following Prickly Heat*, p. 762). M.D., Cornell University Medical School, 1930. Intern, Grasslands Hospital, Valhalla, 1930-31. Associate attending dermatologist, New York City Correction Hospitals; associate attending dermatologist and assistant dermatologist, out-patient department, St. Luke's Hospital; assistant dermatologist, Vanderbilt Clinic; instructor, dermatology, College of Physicians and Surgeons, Columbia University. Fellow: New York Academy of Medicine; American Medical Association; member: American Academy of Dermatology and Syphilology; Society for Investigative Dermatology. Diplomate American Board of Dermatology and Syphilology.
- Moore, Charles M.**, Lieutenant (DC) USNR (*A Modified Apicoectomy Technic*, p. 729). D.D.S., Temple University Dental School, 1938. Resident dental intern, 1938-39, and assistant attending dental surgeon, visiting staff, 1940-, Mountainside Hospital, Montclair, N. J.; private practice, Montclair, N. J., 1939-42. Member: Essex County Dental Society; New Jersey State Dental Society; American Dental Association; Associated Physicians of Montclair and Vicinity.
- Schneierson, Samuel J.**, Lieutenant Commander (MC) USNR (*Simplified Method for Indirect Blood Transfusions*, p. 766). M.D., Long Island College of Medicine, 1926. Intern, 1926-28, and adjunct attending physician, 1930-42, Lebanon Hospital, New York City; adjunct attending physician, Jewish Memorial Hospital, 1936-; associate attending physician, Lebanon Hospital, 1943-. Fellow American Medical Association; member New York State Medical Society. Diplomate American Board of Internal Medicine.
- Spence, Harry M.**, Lieutenant Commander (MC) USNR (*Cystoscopic Clinic at an Advance Naval Base Hospital*, p. 763). M.D., Harvard Medical School, 1930. Surgical house officer, 1930-32, and resident in urology, 1932-34, Massachusetts General Hospital, Boston; private practice of urology, Dallas, Texas, 1936-42; urologist: Dallas Medical and Surgical Clinic Hospital; Parkland Hospital, Dallas, Texas; Dallas Syphilis and Venereal Disease Clinic; Freeman Memorial Clinic; staff: Baylor University Hospital, St. Paul's Hospital, Texas Children's Hospital, Dallas. Fellow: American College of Surgeons; American Medical Association; member: American Urological Association; Southern Medical Association; Texas State Medical Association; South Central Branch of American Urological Association. Diplomate American Board of Urology.
- Spingarn, Clifford L.**, Lieutenant (MC) USNR (*Cold Hemagglutinins in Infectious Mononucleosis*, p. 717). A.B., Columbia College, 1933; M.D., Columbia University College of Physicians and Surgeons, 1937. Intern, Mount Sinai Hospital, New York, N. Y., 1937-40; instructor in pharmacology, Columbia University College of Physicians and Surgeons, 1940-42.

Whitaker, Walter M., Lieutenant Commander (MC) USNR (*Meningococcic Infections*, p. 650). M.D., Washington University School of Medicine, 1927. Intern and house physician in medicine, Barnes Hospital, St. Louis, Mo., July 1927-Jan. 1929; exchange-fellow with East London Hospital for Children, London, England, under Barnes—St. Bartholomew Reciprocity Plan, Jan. 1929-Dec. 1929; private practice, Quincy, Ill., 12 years (including 7 years as cofounder of Quincy Clinic, Quincy, Ill.); pediatrician and cardiologist; Quincy Clinic; St. Mary's Hospital, Quincy, Ill. Member: American Academy of Pediatrics; Adams County Medical Society; Illinois State Medical Society; American Medical Association. Diplomate American Board of Pediatrics.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1944—603196

55

UNITED STATES NAVAL MEDICAL BULLETIN



PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY

IME 43

NUMBER 5



NOVEMBER 1944

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

Digitized by Google



Original from
UNIVERSITY OF CALIFORNIA

COVER PHOTOGRAPH

“Knee Deep in Guadalcanal” is the apt caption by a Marine writer for this photograph, which shows what an 8-inch rain in the Solomon Islands can do to a camp area. The rainy season, which occurs between November and May, imposes added problems of sanitation and preventive medicine upon the unit’s medical department personnel.

—Official U. S. Marine Corps Photo.

VOL. 43

NOVEMBER 1944

NO. 5

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1945,
Public Law No. 347, approved June 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor*
Commander, Medical Corps,
United States Naval Reserve, Retired.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV
SPECIAL ARTICLES	
Liver Involvement in Malaria — <i>Richard A. Kern and Robert F. Norris</i> ...	847
Relapsing Malaria; Analysis of Cases from the Solomons — <i>Ralph J. Metcalf and John Ungar, Jr.</i>	859
Air Embolism in Immersion Blast — <i>Frank J. Gouze and Robert Hayter</i> ..	871
Adherent Scars of the Lower Extremity — <i>George V. Webster</i>	878
Complications Following Tattooing; Report of a Case; Sensitization and Desensitization to Mercury — <i>Marion B. Sulsberger, Abram Kanof, and Rudolf L. Baer</i>	889
The Dental Status of Midshipmen; Sixteenth Class, U.S.N.R. Midshipmen's School, New York City — <i>James M. Dunning</i>	895
Preliminary Bite-Wing Roentgenographic Examination of Naval Aviation Cadets — <i>Don Parle White</i>	901
Psychoses in Naval Inductees with Less than Fifteen Days' Active Duty; Need for Early Elimination of Potentially Psychotic — <i>Otto Allen Will, Jr.</i>	909
Medical Problems in Amphibious Warfare; The LST in Evacuation of Casualties — <i>Tracy D. Cuttle and John N. Marquis</i>	922
Medical Experiences on an APD — <i>William S. Gevurtz and Albert J. Michel</i>	930
Hospital Ship in Amphibious Action — <i>Frank F. Wildebush and James E. Climer</i>	937
Pathogenic Enteric Bacilli; II. The Salmonella Group — <i>LaVerne A. Barnes</i>	939
Filariasis; Clinical Findings in 189 Cases — <i>Paul A. G. Johnson</i>	950
Filarial Problem on Nanumea — <i>Robert B. Venner</i>	955
Eyeglasses for Combat — <i>Arthur Alexander Knapp</i>	964

	Page
Early Use of Sounds for Gonorrheal Urethritis—<i>Francis A. Beneventi</i>..	967
Medical Illustration—<i>John T. Stringer, Jr.</i>.....	970
PENICILLIN	
Penicillin in the Treatment of Primary Atypical Pneumonia; Report of Nine Cases—<i>James J. Short</i>.....	974
Penicillin Therapy in Phagedenic Ulcer (Tropical Sloughing Phagedena); Report of Eighteen Cases—<i>William G. Hamm and G. Ouary</i>	981
Chemotherapy, Pyrotherapy and Penicillin in the Treatment of Gonorrhea—<i>Davis H. Párdoll and Robert L. Dennis</i>.....	988
Penicillin in Sulfonamide-Resistant Gonorrhea; Supplementary Report of 144 Cases—<i>John G. Menville and Clarence W. Ross</i>..	997
Penicillin in Treatment of Rheumatic Fever and Gonococcal Infections—<i>John R. Twiss</i>.....	1001

CLINICAL NOTES

PENICILLIN	
Subacute Bacterial Endocarditis Successfully Treated with Penicillin—<i>Francis W. Pizzi and Frank W. McCarthy</i>.....	1010
Agranulocytosis Treated with Penicillin; Report of Case—<i>Howard B. Sprague and L. Kraeer Ferguson</i>.....	1014
Penicillin in Malignant Granulocytopenia; Report of Case—<i>William C. Meredith, Albert H. R. Douglas, and Harold Fink</i>.....	1017
Penicillin in Treatment of Human Bite Infections; Report of Two Cases—<i>C. Joseph Delaney</i>.....	1020
Cerebrospinal Fever Treated with Cisternal Administration of Penicillin; Report of Case—<i>L. Tate Miller and Clarence W. Ross</i>	1023
Yaws Treated with Penicillin; Report of Case—<i>Robert C. Lofgren</i>	1025
Penicillin Therapy in Gonorrhea with Associated Undiagnosed Early Syphilis—<i>Joseph F. Ricchiuti</i>.....	1031
Effects of Subtherapeutic Dose of Penicillin on Development of Primary Syphilitic Lesion; Report of Case—<i>Greydon G. Boyd, Joseph A. Wagner, and George F. Hewson</i>.....	1034

MEDICAL AND SURGICAL DEVICES

Improvised Metal Pins for Skeletal Transfixion—<i>Moore Moore, Jr.</i>....	1036
Method for Individual Transportation of Plasma in the Field—<i>George Linn Watkins</i>	1038
Refrigeration of Wounded Extremities—<i>John P. Ottaway and John J. Foote</i>	1041
Wardroom Operating Table for Destroyers—<i>Charles Mrazek</i>.....	1044
Safety Lock for Folding Field Operating Table—<i>Justus M. Fleming</i>....	1047

EDITORIALS

	Page
Penicillin	1048
Streptococcus MG and Primary Atypical Pneumonia	1049
Food and Wound Healing	1051

BOOK NOTICES

Human Constitution in Clinical Medicine, Draper, Dupertuis, and Caughey—Medical Physics, editor-in-chief, Glasser—Clinical Lectures on the Gallbladder and Bile Ducts, Weiss—Guiding the Normal Child, Bowley—Fundamentals of Occlusion, Hemley—A Text-Book of Pathology, edited by Bell—Rehabilitation, Re-education and Remedial Exercises, Smith—Pharmacology, Oxford Medical Outline Series, Mulinos—Scabies, Oxford War Manuals, Mellanby—Health for the Having, Emerson	1053
--	------

PREVENTIVE MEDICINE

Sulfa-Mercury Compound for Venereal Prophylaxis—James F. Blute, Jr.	1063
Epidemic of Food Infection Caused by Salmonella Montevideo—William A. Myers and Lucius E. Eckles	1067
NOTES ON OUR RESERVE CONTRIBUTORS	1074

U. S. NAVAL MEDICAL BULLETIN

VOL. 43

NOVEMBER 1944

No. 5

SPECIAL ARTICLES

LIVER INVOLVEMENT IN MALARIA¹

RICHARD A. KERN
Captain (MC) U.S.N.R.

and

ROBERT F. NORRIS
Lieutenant Commander (MC) U.S.N.R.

In the course of a clinical experience involving 1,153 cases of malaria seen on a hospital ship, it was impressive to note the frequency with which enlargement of the liver was present during active malaria. In rare instances the enlarged liver gave rise to symptoms which dominated the clinical picture. Since the usual textbook articles on malaria are either silent on the subject or give an inadequate description of the hepatic involvement in this disease, we have collected data, including the findings on physical examination, the observations on liver function as tested by the van den Bergh reaction and by bromsulfalein excretion, and the pathologic anatomy of the liver in two patients who died of malaria, and in four others with recent malaria who died of wounds or intercurrent illness.

PHYSICAL FINDINGS

Enlargement of the liver was found 59 times in 100 consecutive proved malarial patients. In this series the size of the liver varied from "just palpable" to "easily felt," and from 1 or 2 cm. to 5 or 6 cm. below the costal margin in the midclavicular line. The frequency with which the hepatic enlargement was associated with splenic enlargement, and its relation to the type of infection are shown in table 1.

¹ Received for publication 28 August 1943.

TABLE 1.—*Incidence of palpability of liver and spleen in 100 cases of malaria*

Type of plasmodium	Species undetermined	Falciparum	Vivax	Malariae	Mixed vivax and falciparum	Total cases
Liver and spleen palpable.....	22	20	11	1	1	55
Only spleen palpable.....	12	9	9	0	0	30
Only liver palpable.....	0	1	3	0	0	4
Neither liver nor spleen palpable.....	9	1	1	0	0	11
Total cases.....	43	31	24	1	1	100

It will be seen that two-thirds of the patients with falciparum infection had an enlarged liver. This was a somewhat higher incidence than among the vivax cases or among those in whose thick films plasmodia were found, but the species of plasmodium could not be identified. In this latter group the chances are that a majority were vivax infections. In four patients the liver was palpable in the absence of a splenic tumor. Those patients whose spleen and liver were not enlarged were mostly afebrile at the time of examination. However, all the patients in the series had had fever within a week of the time of examination.

The enlargement of the liver, like that of the spleen, seemed to follow the course of the disease. It was not palpable at the onset of the disease, but enlarged during the first few days of fever and tended to remain so during the duration of symptoms. It likewise grew smaller as the fever subsided under treatment. In some patients it was no longer palpable a few days after the temperature was normal; in others it still could be felt for weeks after an attack. The enlargement was uniform, as there appeared to be no preponderance of one lobe over the other. The surface was always smooth.

The consistency of the enlarged liver varied considerably. In the earlier stages, even though the liver was demonstrably enlarged to percussion, it was difficult or impossible to feel, suggesting a relatively soft and virtually normal consistency. Later it became somewhat firmer and much easier to feel. The liver was best palpated just to the right of the outer border of the right rectus muscle with the finger tips of the examining right hand held almost flat on the abdomen and parallel to the rectus fibers. The left hand in the costovertebral angle pressed the liver forward, so that, as the patient took a deep breath with his mouth open, the somewhat thickened and rounded edge of the liver could be made to slip past the examining finger tips with a sudden jerk. In a few instances the liver was fairly firm; these were patients whose symptoms had lasted a longer time and through a succession of febrile episodes. However, this trend of liver change was

by no means comparable in degree to that which is well known to occur in the spleen as malaria becomes chronic. Nor did the liver of these patients ever feel as firm as that of a cirrhotic involvement. Whether greater firmness might develop in chronic cases of long duration we cannot say, since the longest duration of the malaria in any of our patients was only 6 months.

Tenderness of the liver was present on palpation in 8 of the 59 patients referred to in table 1 as having a palpable liver. Tenderness in the right hypochondrium, probably also of hepatic origin, was not infrequently noted in the absence of a palpable liver. Occasionally this tenderness was pronounced and associated with actual pain in the liver area.

Jaundice was absent, as a rule. When present, it was confined to a muddiness of the sclerae, that usually left the examiner in doubt until the van den Bergh test was reported. The highest reading noted by us was 3.5 mg. of bilirubin per 100 cc. The matter was, of course, complicated clinically by the universally present yellow tinge of the skin due to atabrin.

SYMPTOMS

It was impossible to correlate with regularity any specific symptoms directly with the hepatic involvement. Anorexia seemed more prevalent in the patients with enlarged livers, and in some appeared to be associated with nausea and vomiting. In a few, anorexia plus malaise and what old clinicians used to call a "livery" appearance suggested mildly the term cachexia. But these are merely clinical impressions. There was no generalized itching even in the patients with slight clinical jaundice. Even though a liver was tender on palpation, subjective pain over that organ was rare, although it did occur. Tenderness and any pain over the liver tended to focus the attention of the medical officer on that organ. If at the same time the spleen was not palpable, then suspicion was all the more diverted from the possibility of malaria. An outstanding example of this is offered by the following case:

Case 1.—A private, first class, USMCR, 18 years of age, was admitted to this ship with a diagnosis of abscess, multiple, hepatic. He reported at sick call because of headache, abdominal distress, nausea and vomiting. On examination at that time he was found to have a fever of 102° F., which continued high. In a week the liver was found enlarged two fingers' breadth below the ribs and distinctly tender. There was a suggestion of jaundice, but the stools were normally dark. The symptoms continued, and at times his vomiting was so severe that he was given dextrose solution intravenously.

He continued to have fever and became obviously anemic. Approximately 1

month after his first visit to the sickbay his blood count showed 2,290,000 red cells and 7,800 leukocytes. Two days later the red cells had fallen to 1,580,000 and the leukocytes to 4,600, of which 22 percent were segmented and 10 percent band forms, 64 percent lymphocytes, 3 percent monocytes, and 1 percent eosinophils.

Within 1 week he received 4 whole-blood transfusions amounting to 2 liters. Ten days later the count had risen to 2,040,000 erythrocytes and 13,100 leukocytes. No malarial plasmodia were found in thick or thin smears. The temperature continued to fluctuate daily between normal and 105° F.

He was transferred from the beach to a transport, in whose sickbay he remained for the next week. Here again he was examined; but no further conclusion was reached than that of an acute liver disease, probably infectious in nature and with abscess formation. Severe anemia was the outstanding finding, and consequently 2 more transfusions were given. Blood counts on 2 successive days showed respectively 1,240,000 and 1,420,000 red cells, 35 and 40 percent hemoglobin, and 6,000 and 4,400 leukocytes.

When he was admitted to this ship, he was pale and emaciated. He appeared to be in some distress, and complained of right upper abdominal discomfort. The skin had a suggestion of icterus, but the urine on two occasions was clear amber in color, contained no bile, and was negative in other regards. The liver was palpable and quite tender. The spleen was not palpable. The lungs were normal. The temperature ranged between 99° and 102° F.

When the patient was seen on the following day, the significant findings were: Obvious pallor, but no icterus; high diaphragm on the right (not immobilized); liver extending well below the ribs, easily palpable and definitely tender; a systolic apical murmur. The spleen could not be felt, but the splenic dullness on percussion seemed enlarged. The blood count on that day showed 1,830,000 red cells, 39 percent hemoglobin, 3,800 white cells of which 8 percent were segmented and 38 percent band forms, 47 percent lymphocytes, 5 percent monocytes, and 1 percent each of eosinophils and basophils.

On that day a thick bloodfilm was found to contain great numbers of malarial parasites, and the thin film showed numerous ring forms and trophozoites typical of *Plasmodium vivax*.

Treatment with quinine sulfate, 15 grains three times a day, was begun at once and continued until the time of his transfer to a hospital ashore. He also was given two transfusions of 500 cc. each.

The improvement in the patient's condition was marked. His temperature promptly fell to normal and remained so for the rest of his stay on board. The size of the liver grew smaller, and the subjective discomfort in the hepatic region as well as tenderness on palpation over the liver promptly disappeared. He ate and slept well. On the day before discharge the blood count was 2,720,000 red cells, 61 percent hemoglobin, 3,400 leukocytes, with 36 percent segmented and 10 percent band forms, 52 percent lymphocytes, and 2 percent eosinophils. The coagulation time was 4½ minutes and the bleeding time 2½ minutes. A stool examination revealed no ova or parasites.

LIVER FUNCTION TESTS IN MALARIA

The van den Bergh reaction was applied in a series of 54 malarial patients who were febrile at the time or who had had fever within a week of the test. Some of the salient data are presented in table 2.

TABLE 2.—*The relation of 61 van den Bergh readings to hepatomegaly and fever in 54 malarial patients*

Serum	Bilirubin mg./100 cc.	0-0.5	0.51-1.0	1.01-1.5	1.51-2.0	2.01-2.4	2.51-3.0	3.01-3.5
Large liver...	With fever.....	5	10	3	.....	.....	2	1
	No fever.....	6	1	3	.....	1	1	.....
Small liver...	With fever.....	9	6	1	.....	.....	.....	.....
	No fever.....	9	2	1	.....	.....	.....	.....

If 0.5 mg. of bilirubin per 100 cc. of serum is accepted as the upper limit of normal, then most abnormal readings were obtained when both hepatomegaly and fever were present (16 out of 21), fewer in the presence of hepatomegaly without fever (6 out of 12), fewer still in the absence of hepatomegaly but with fever (7 out of 16), and least when there was neither hepatomegaly nor fever (3 out of 12). Moreover the patient in this last group who gave the highest reading (1.1) may well have been, according to his history, in the subsiding stage of a catarrhal jaundice. The reaction was delayed or biphasic in all but 3, in which a direct reaction occurred with bilirubin values of 3.5, 2.68, and 2.62. The patients with falciparum infection tended to give slightly higher readings than those with other types, but there were not sufficient cases in each group to make this difference statistically significant.

It should be pointed out that during the administration of atabrin the skin of the individual has a distinctly yellow color that may be mistaken for jaundice. Atabrin, however, does not discolor the sclerae to the extent that even mild degrees of jaundice would produce, and it does not affect the van den Bergh reading.

The bromsulfalein elimination test.—A supply of bromsulfalein for testing liver function was obtained and a dose of 5 mg. per kilogram of body weight was injected intravenously. The amount remaining in the blood was estimated in samples removed at the end of 5 and 30 minutes respectively. In young patients normal figures should be 40 percent and a trace or none remaining at the times named. Nineteen observations were made in 12 young patients. In 7 patients, tests were made before and after a period of active antimalarial treatment with quinine and atabrin. In 5 patients a single test was made during or after a period of treatment. The results are recorded in table 3.

In general, there is fairly close correlation between the two tests, except in cases 4 and 8, in which the van den Bergh test gave a virtually normal reading in one test when the bromsulfalein test showed impaired function, and in cases 5 and 10 which had a slightly elevated serum bilirubin level but a normal bromsulfalein elimination. As a rule, one or both tests gave abnormal

TABLE 3.—Results of 19 bromsulfalein and van den Bergh tests in 12 cases of malaria

Case No.	Type of infection	Present at time of test			van den Bergh mg./100 cc.	Percentage of bromsulfalein		Time relation of tests to treatment
		Big * spleen	Big * liver	Fever		After 5'	After 30'	
1	Vivax.....	0	0	Plus	0.93	60	10	Before.
		0	0	0	.38	40	0	After 19 days treatment.
2	do.....	3	3	Plus	.58	100	20	During.
		3	2	0	.25	70	Trace	After 17 days treatment.
3	do.....	0	2	Plus	1.0	95	25	Before.
		0	0	0	.28	30	Trace	After 18 days treatment.
4	do.....	3	0	Plus	.25	60	5	Before.
		2	0	0	.25	30	0	After 14 days treatment.
5	do.....	2	0	Plus	.57	30	0	During.
6	do.....	3	0	0	.38	40	0	After.
7	do.....	0	0	0	.36	40	0	Do.
2 8	Falciparum.....	3	3	0	.96	50	10	Before.
		2	2	0	.2	50	5	After 13 days treatment.
9	do.....	1	0	Plus	.92	50	Trace	Before.
		1	0	0	.38	30	0	After 15 days treatment.
10	do.....	0	1	Plus	.56	40	0	During.
11	Mixed f. & v.....	0	0	0	.27	30	0	After.
		0	0	Plus	1.26	70	10	Before.
3 12	Undetermined.....	0	0	0	1.48	80	(4)	After 19 days treatment.

* Measurement in centimeters below ribs at expiration.

¹ A case of double vivax infection with daily chills.² See text.³ Coexisting tertiary syphilis.⁴ Not done.

findings in the presence of an enlarged liver. The degree of abnormality was much more marked in the case of the bromsulfalein test.

Case 8 in the table was that of a patient who had a negative blood film, and no signs of active malaria, but who felt "out of sorts," with anorexia and headache, had a palpable liver and spleen, and was anemic (65 percent hemoglobin). Since there was a history of an attack of falciparum malaria 6 weeks before, it was felt that he might have a subclinical malarial infection that was responsible for the enlarged liver and his symptoms. He was therefore given a course of treatment with quinine and atabrin. After 13 days he felt better, the liver was a little smaller, the hemoglobin was 78 percent, and the tests of liver function showed improvement, especially the van den Bergh.

Case 12 in table 3 was that of a man with a history of subclinical malaria of several months' standing and the first acute attack recently, for which he had been admitted to the sick list. He also had a history of syphilis and a strongly positive Kahn test. Since a Kahn test a year before had been negative, it was at least possible that malaria accounted for a falsely positive Kahn. On the other hand, syphilis or the arsenicals used in its treatment might have been responsible for a damaged liver. Liver function tests, both before and after 19 days of antimalarial therapy, showed marked impairment of dye excretion and a distinctly elevated

serum bilirubin. The patient was transferred to another activity before further study could be completed.

Pathologic anatomy of the liver in malaria.—In two fatal cases of malaria it was possible to examine the liver after death.

Case 2.—A private, USA, age 30, was brought on board in a semistuporous condition. The record noted malarial symptoms of uncertain duration and the finding of falciparum plasmodia in the blood. His condition was obviously critical. There were signs of consolidation at both lung bases, abdominal distention, vomiting, and a greatly diminished urinary output. Laboratory data included: Hemoglobin 39 percent; 128 mg. of urea nitrogen per 100 cc. of blood; albumin, red cells, and casts in the urine; and falciparum plasmodia in the blood. Intravenous medication, fluids, and blood transfusions were of no avail, and he died 29 hours after admission.

At necropsy, the liver was found to be moderately enlarged. The parenchyma was swollen and bile-stained. The lobules were distinct, but the centers were pale. Under the microscope no areas of necrosis were found, but the parenchymal cells in the centers of the lobules were shrunken and contained excessive amounts of granular yellow pigment. The Kupffer cells were much more numerous than normal and were distended with much brown and black pigment. The anatomic diagnosis was central and midzonal atrophy of the liver.

The other findings included splenic enlargement with marked malarial pigmentation of the spleen as well as of the reticulo-endothelial system generally, a cholemic nephrosis and a widespread hemorrhagic bronchopneumonia.

The final diagnosis was *P. falciparum* malaria, terminal uremia, and bronchopneumonia.

Case 3.—A private, USMCR, age 22, was transferred to this ship with a diagnosis of malaria (species undetermined). No details of history were available except that of voiding black urine for several days, of being comatose and incontinent of feces for 2 days, and of being given plasma, a blood transfusion, intravenous dextrose and saline solutions, and an intravenous injection of atabrin at various recent intervals. On admission, he was extremely weak, emaciated, dehydrated and scarcely able to whisper. There was a positive Kernig's sign and hyper-reflexia, but no rigidity of the neck. The blood count showed 1,430,000 red cells, 29 percent hemoglobin, and 3,800 white cells. The urine was black and contained many red cells and much albumin. The thick blood film showed enormous numbers of malarial parasites, and the thin film great numbers of small ring forms, a few gametocytes of *Plasmodium falciparum*, and some large ring forms that may have been vivax or quartan plasmodia. Treatment consisted in daily transfusions, intravenous fluids, 0.3 gm. of atabrin in divided doses by vein and intramuscularly, and one dose of quinine intravenously. He was almost anuric and the blood urea nitrogen level after 48 hours was 112 mg. per 100 cc. He died 4 days after admission with terminal manifestations of bronchopneumonia.

At necropsy the liver was enlarged and greenish-black. On section the parenchyma bulged from its cut surface and the lobules were indistinct. Microscopically the parenchymal cells about the central veins had disappeared in nearly all the lobules. In the midzonal and periportal areas they were markedly swollen with indistinct cell walls. As a result, not only the sinusoids but also the periportal spaces were compressed. Kupffer cells containing

brown pigment almost filled the lumina of the sinusoids. The anatomic diagnosis was acute hepatitis and central and midzonal necrosis of the liver lobules.

The spleen, twice the normal size, was black, soft and swollen. The malpighian bodies and trabeculae were indistinct. In microscopic section the malpighian bodies were small and the lymphoid tissue was atrophied. The reticulo-endothelial cells between the sinusoids were more numerous than usual, and contained large amounts of yellow pigment.

The kidneys, twice normal in size, showed small hemorrhages in the areolar tissue about the capsules, a smooth pale surface under the easily stripped capsule, and on section a swollen pale parenchyma. Microscopically the glomeruli were diffusely swollen, and the capillaries nearly bloodless. Both the proximal and distal convoluted tubules were swollen, most of the cells were necrotic, and the lumina generally obliterated.

Malarial pigment was widely distributed in spleen, liver, kidneys, lungs and bone marrow.

The final diagnosis was *P. falciparum* malaria, blackwater fever, terminal uremia and lobular pneumonia.

It is admitted that there is a distinct possibility that the central lobular necrosis of the liver lobules found in this case may have been in part due to the effect of atabrin, parenterally administered. Such necrotic changes have been described by others as occurring in experimental animals that have received toxic doses of this drug.

DISCUSSION

The outstanding fact to which attention is directed in this report is that demonstrable involvement of the liver occurs in a majority of all cases of malaria and in all stages of the disease, including the earliest acute attack. Furthermore the incidence is far greater than is commonly realized.

All the textbooks on medicine and pathology at our disposal were carefully consulted. References to the liver in the discussion of malaria were very meager. Meakins says "the liver may be enlarged and the spleen is palpable;" also that in fatal cases "the liver is enlarged and [shows] blockage of the small vessels, and the endothelial and reticulo-endothelial cells are gorged with parasites. There is great congestion of the organ, and deposits of pigment may readily be seen." Osler refers to the liver only in the section on pathology under pernicious malaria: "The liver is swollen and turbid." Under malarial cachexia he says "In fatal cases of chronic paludism * * * the liver may be greatly enlarged and of grayish-brown or slate color, due to the large amount of pigment." Under the section on accidental lesions, where the "malarial hepatitis," alleged to play "an important role in malaria as described by French writers," is deprecated, the opinion is given that "Only those cases, in which the history is

definite and in which melanosis of both liver and spleen coexist, should it be regarded as of malarial origin."

Smith and Gault say, "In acute malaria the liver is usually not grossly enlarged, but in the chronic form the organ may be somewhat increased in size."

With the exception of Meakins, who says that "the liver may be palpable" in early cases, all the authors of texts consulted consider liver involvement in malaria as a part only of "pernicious," "late," or "fatal" disease. We wish to emphasize that liver involvement is not only a frequent, but an early feature in malaria. To prove this point, data on the frequency of hepatic enlargement and of elevation of the van den Bergh reading in different stages of the disease are presented in table 4.

TABLE 4.—*Relation of hepatomegaly and of hyperbilirubinemia to the stage of the disease in 54 cases of malaria*

Number of attack	Total cases	Liver		van den Bergh	
		Enlarged	Not enlarged	Increased	Normal
First.....	21	14	7	13	8
Second.....	16	11	5	9	7
Third.....	11	5	6	9	2
Fourth.....	5	3	2	2	3
Fifth.....	1	0	1	0	1

It is clear that enlargement of the liver is as common in the first attack of a patient's malaria as in subsequent outbreaks. (By "attack" is meant a period of continuous symptoms not terminated by treatment. Such a period might be of a few days' or weeks' duration. It is not synonymous with "admission to the sick list," since a patient might actually have continued on duty while taking medicine.) Similarly an increased van den Bergh reading is as common in the first as in later attacks. Nor is there any difference in the degree of enlargement or altered function in later as compared with earlier attacks.

As to the exact nature of the pathologic change in the liver in these early acute cases of malaria, we have no direct information. That would require biopsy material obtained in the midst of such a malarial attack. Nor can one draw any conclusions based on specimens obtained at necropsy in fatal cases of malaria, for even though the changes in the early cases are similar in kind to those in the late, fatal cases, they would still differ in degree and to an extent that remains unknown.

However there is a clue as to how much less marked the early change must be as compared with the late. It is furnished by

some material obtained at necropsy in young men who died from causes other than malaria, who had been weeks or at most a few months in a malarial area, and in whom the spleen showed unmistakable evidence of previous malarial infection. The findings consisted of a splenomegaly grossly, while microscopically prominent sinusoids and littoral cells were seen and obviously malarial pigment in the reticulo-endothelial cells. Unfortunately the patient's records dealt only with the immediate cause of the individual's admission to the ship and so gave no information as to any possible previous clinical manifestation of malaria.

CASE REPORTS

Case 4.—A machinist's mate, first class, USNR, 34 years of age, developed a sore throat, the diphtheritic nature of which was not discovered until he was first admitted to the sick list about a month later because of generalized aches and pains. Full doses of antitoxin failed to prevent the onset of post-diphtheritic paralysis, involving first the palatal and pharyngeal muscles, and eventually both phrenic nerves. The latter complication quickly led to his death 3 days after his admission to this ship. At necropsy the spleen showed clear-cut evidences of malaria. The liver was normal in size. Microscopically there were only slight fatty changes in the parenchymal cells.

Case 5.—A sergeant, USMC, age 22, received shrapnel wounds of the left thigh that led to amputation 3 days later, after signs of gas bacillus infection had appeared. He was admitted to this ship in a state of shock and died 9 days after his original injury. At necropsy the spleen showed definite evidences of malaria. The liver was normal in size. Microscopically the parenchymal cells all appeared swollen and as a result the sinusoids were small.

Case 6.—A captain, USMCR, 24 years old, was wounded in the left thigh and scrotum by a bullet. Upon admission to this ship he showed signs of gas bacillus infection from which he died 36 hours later, 12 days after being wounded. At necropsy the spleen showed obvious evidences of malaria. The liver was larger than normal. On microscopic examination, the parenchymal cells were generally swollen, with indistinct cell walls. The sinusoids were compressed. Some of the Kupffer cells contained malarial pigment.

Case 7.—A private, USMCR, age 19, suffered a gunshot wound of the right forearm. Eight days later he was admitted to this ship in a serious condition with evidences of gas bacillus infection in the wound. He died 11 days after his original injury. At necropsy, the spleen showed unmistakable evidence of malaria. The liver was normal in size. In microscopic section the parenchymal cells were slightly swollen and the sinusoids appeared compressed.

In all four of these cases there were similar changes in the liver, consisting of swelling of the parenchymal cells and consequent compression of the sinusoids. These are comparatively mild lesions and certainly reversible to a normal state in a short time.

They are comparable in kind, although very much less in degree, with the lesions found in the two fatal cases of malaria.

The probability of the changes found in the livers of the last four cases being the result of the fatal wound or illness is admitted but it does not necessarily exclude the malarial origin. It is not certain by what mechanism liver damage in malaria is produced. The pathologic change in the liver that occurs in acute cases with such frequency is probably at most a swelling of the parenchymal cells and resultant compression of the sinusoids. When malarial pigment is found in the Kupffer cells, obviously the malarial parasite itself or its disintegration products are involved. But the swelling of the parenchymal cells of the liver most probably is due to the effects of the products of hemolysis, especially those that come to the liver from the spleen. These products of hemolysis may have an augmented ability to produce changes as a result of having been modified by the action of the plasmodia.

In view of the frequency of liver damage in malaria a diet rich in carbohydrates and proteins and poor in fats would seem indicated.

A more recently published article by Kopp and Solomon¹ corroborates the observations recorded in this communication. They found in 9 paretics with induced therapeutic tertian malaria, a transient impairment of liver function as shown by moderate bromsulfalein retention, a marked reduction in cholesterol and cholesterol esters, a moderate fall in the phospholipids, diminished hippuric acid excretion and a strongly positive cephalin flocculation test. One of their patients developed jaundice during malarial therapy, which they believe due to liver damage, possibly conditioned by previous liver damage from prolonged arsenical therapy. They suggest that impairment of liver function in malaria may be due to the marked reduction in serum albumin with depletion of the proteins in the liver.

SUMMARY AND CONCLUSIONS

1. In a series of 1,153 cases of malaria we were impressed with the frequency of involvement of the liver in all types of infection and in all stages of the disease.
2. The liver involvement manifests itself in 60 percent of cases by a palpable enlargement that fluctuates with the activity of the disease. It increases during the continuation of an active febrile

¹ KOPP, I., and SOLOMON, H. C.: Liver function in therapeutic malaria. *Am. J. M. Sc.* 205: 90-97, January 1943.

attack and decreases promptly following successful antimalarial therapy.

3. The liver involvement is attended by impaired hepatic function as shown by increased van den Bergh readings of blood bilirubin, but rarely reaching the stage of obvious jaundice, and by bromsulfalein retention. The impairment of function of the liver, like the enlargement of that organ, varies with the activity of the disease.

4. Clinically the liver condition may give rise to anorexia, occasionally to nausea and vomiting, and perhaps to other vague symptoms that might be called "cachectic." The enlarged liver is at times tender to palpation and in rare instances is painful, suggesting the possibility of liver abscess.

5. The presence of liver involvement is not an evidence of chronicity; it was found as frequently in the first bout of malaria as in later attacks.

6. The nature of the liver change is uncertain; at most it may be a swelling of the parenchymal cells and attendant compression of the sinusoids, plus the finding of malarial pigment in the Kupffer cells.

7. The presence of liver enlargement in malaria, the changes in hepatic size, and the results of tests of its function may be helpful at times in directing and evaluating the efficacy of anti-malarial treatment.

8. The use of a high-carbohydrate, high-protein, low-fat diet would seem indicated in malaria to spare the liver from further damage.



CONTRAINDICATIONS FOR USE OF PENICILLIN

The use of penicillin should not be attempted in the treatment of gram-negative bacillary infections, including undulant fever, tularæmia, influenza, infections due to the colon-typhoid-dysentery group or infections due to *Klebsiella pneumoniae*. Infections of the urinary tract due to gram-negative organisms do not respond to penicillin. It has not proved useful in treatment of tuberculosis, acute rheumatic fever, lupus erythematosus, pemphigus, mononucleosis, leukemia, ulcerative colitis, malaria or blastomycosis.—HERRELL, W. E.; NICHOLS, D. R.; and HEILMAN, D. H.: Penicillin; its usefulness, limitations, diffusion and detection, with analysis of 150 cases in which it was employed. J. A. M. A. 125: 1003-1011, August 12, 1944.

RELAPSING MALARIA

ANALYSIS OF CASES FROM THE SOLOMONS

RALPH J. METCALF

Lieutenant Commander (MC) U.S.N.R.

and

JOHN UNGAR, JR.

Lieutenant (MC) U.S.N.R.

Many of the territories where our forces have operated are heavily infested with malarial vectors and hosts, so that despite heroic preventive measures, increasing numbers of malarial casualties have been incurred. Men of the Services are nonresistant to tropical diseases in general and malaria in particular. Often they must live in close proximity to natives whose blood is abundantly supplied with gametocytes. Engineering problems remain to be solved; screening and repellents are often lacking or incapable of usage; enforcement of suppressive drug therapy may be sporadic or impossible. These factors explain the large numbers of infected individuals. Add to this the potential danger of returning large numbers of these men into currently almost malaria-free zones, both at home and abroad, where mosquito vectors are known to be present, and the seriousness of the problem becomes even more apparent.

It is the purpose of this article to analyze a limited number of cases observed at one activity. All cases, with the exception of two, were in men who had been evacuated to this country following the initial engagement in the Solomon Islands. All had been subjected to the adverse conditions previously stated, i.e., lack of screening and repellents, exposure to tropical climate without protection, inadequate or no shelter, insufficient food or rest, and sporadic administration of suppressive treatment. Many when they did become clinically ill with fever and chills, were not admitted to a sickbay because often none was available, but were given quinine or atabrin therapy for a brief period by the medical officer or corpsman in their foxholes or tents, and were of necessity returned to duty within 3 to 5 days. As soon as conditions permitted they were admitted to a sickbay and subsequently evacuated for further treatment. Most of the men stated that they had had several spells of fever and chills which they had not

reported. Practically all told of having had "enteritis" during the first few days of their stay on these islands, all attacks being relatively mild in nature and responding promptly to simple medication.

It is of interest to note in reviewing the health records that the original admission diagnosis for the majority of cases was malaria, *P. falciparum*. In subsequent admissions, usually after the second, malignant tertian malaria disappears from the records and benign tertian malaria is the constant finding. This is in accordance with the generally accepted belief that the malignant form "burns itself out" or responds to treatment readily and is not prone to relapse. There is insufficient evidence as to the suppressive treatment given and one must rely on the patients' stories which are admittedly not too accurate. The conclusion, however, is that they all did receive atabrin in standard doses before landing and as long afterward as was possible, the time varying from a few days to 2 weeks.

Treatment on the islands for an acute attack consisted in most instances of the administration of quinine. Following evacuation, treatment varied with each activity. Some patients received a short course of quinine followed by atabrin, others received quinine alone. The length of the treatment varied but in most cases each course was from 1 to 2 weeks. The number of malarial relapses and courses of treatment varied from as few as 3 to a maximum of 28.

On return to the continental limits all patients were admitted to a Naval hospital where malarial smears were made. In the absence of clinical malaria and with negative smears, many patients, after a relatively short period of time, were granted 30 to 40 days' sick leave and permitted to go to their homes. Many became acutely ill while on leave and were forced to seek treatment at or near their homes. These relapses did not seem to respect any particular climate or altitude. Again the course of treatment, usually consisting of quinine, was short, lasting only until the patients were ambulatory. It was also important to note that the last course of treatment received by all but two patients was at one activity where 3.3 gm. atabrin was routine treatment. The patients had been on the sick list from 30 to 90 days and many (26) were sent to duty and readmitted within 2 days, acutely ill. Fifty percent of the entire group were admitted within 14 days following their discharge to duty.

On admission a complete history was obtained on each patient and physical examination was done. No treatment was instituted until blood smears, thick and thin, had been made. Special atten-

tion was given to the number of relapses and the nature of the previous treatment, particularly the last course. Loss of weight, a history of enteritis, pallor, splenomegaly, and jaundice were considered cause for blood and stool examinations. A mild secondary anemia was commonly found, few patients showing an erythrocyte count as low as 3,000,000. Two patients had had repeated transfusions of whole blood because of severe anemia. Both of them on the present admission had marked splenomegaly, destruction of red corpuscles, leukopenia and diminished platelet counts, but normal bleeding and coagulation times. Eosinophilia in every instance was found to be associated with complications, chiefly intestinal parasites or symptoms and signs of filarial infestation.

Three patients with intensely yellow skin were found to have an increased icteric index and van den Bergh reactions which returned very slowly to normal. After 5 weeks all three developed a very stubborn type of benign tertian malaria, requiring intravenous quinine to free their blood of parasites. Atabrin had been administered in the usual dosage over a prolonged period of time.

Treatment.—Inasmuch as practically every patient had so recently been treated with atabrin, it was decided to use quinine as extensively as conditions would permit. Three optional schedules (A, B, and C) were followed. The drugs used in each and their dosages were:

- A. No. I. Quinine grains 15 t.i.d. for 5 days.
Quinine grains 10 t.i.d. for 5 days.
Quinine grains 15 daily for 6 weeks.
- No. II. Quinine as above with the addition of neoarsphenamine 0.3 gm. intravenously every 3 days for four doses.
- No. III. Quinine grains 15 q.i.d. for 3 days.
Quinine grains 10 t.i.d. for 5 days.
Quinine grains 15 daily for 30 days (minimum).
- B. Quinine and atabrin:
Quinine grains 45 to 60 daily for 3 days.
Atabrin 0.2 gm. t.i.d. for 3 days.
Atabrin 0.1 gm. t.i.d. for 5 days.
Atabrin 0.1 gm. daily for 15 days. Total 4.8 gm.
- C. Atabrin:
Atabrin 0.2 gm. t.i.d. for 3 days.
Atabrin 0.1 gm. t.i.d. for 5 days.
Atabrin 0.1 gm. daily for 15 to 30 days. Total 4.8 to 6.3 gm.

Plasmochin was administered routinely in every case, concurrently with the second week of quinine therapy and during a period of suspension of atabrin, in a dosage of $\frac{1}{2}$ grain daily for 5 days. No adverse effects were observed.

TABLE 1.—*Results of treatment schedules*

Schedule	Number cases	Number relapses	Percent relapses	Number relapses re-treated	Final percent
A I.....	62	20	32	.....	32% of 62
II.....	60	16	27	.....	27% of 60
III.....	76	3	4	27	3% of 103
B.....	17	4	23	.....	23% of 17
C.....	35	8	23	12	17% of 47

16 failures on A I and II were successfully re-treated with A III.

4 failures on schedule C were successfully re-treated with A III.

7 failures on A I and II were successfully re-treated with intravenous quinine plus A III.

12 failures on A I, II, and III were successfully re-treated with C.

12 failures, outcome unknown.

Causes of relapses:

Failure to take drug as directed	A I and II.....	28
Known failure of medication	A I, II and III.....	7
	C.....	8
Unknown	.....	8

Average number of malarial relapses per case since the first attack for 250 consecutive cases (from history)..... 8.1

Positive smears on quinine grains 30 daily after 10 days..... 3.0

Complications:

Entamoeba histolytica	.....	9
Filariasis (bancrofti)	.....	5
Hookworm	.....	2
Giardia	.....	1

It should however be noted that the follow-up statistics may be inaccurate because some of these men, when discharged to duty, were transferred to other activities and the end-results are not known definitely despite the fact that a request "return notice of relapse" was attached to the health record. Only a few were returned. It is entirely possible that there are or will be more instances of relapse.

At first neoarsphenamine was used concurrently with quinine. Results were striking only in that the arsenic made these patients feel better more quickly. It apparently had little effect on the relapse rate, at least not sufficient to warrant its routine use. The first cases were treated with the smaller initial dosage of quinine but because of the high relapse rate the larger initial dosage was adopted. Seven cases relapsed several times under observation despite adequate quinine or atabrin therapy. These patients were all given intravenous quinine followed by the heavier dosage schedule with, so far as is known, good results. Three of these

seven patients had positive smears after the 10-day treatment on schedule A, course I.

Our rather limited experience would indicate that there are several important factors that warrant further consideration.

1. *Climate*.—Returning patients who have had malaria episodes from a sea level climate to a similar sea level climate may prove helpful in preventing relapses. There is little evidence on which to base conclusions. As was stated previously, these men experienced relapses in many parts of the United States when on leave. Such factors as loss of sleep, long hours of fatiguing travel, and excessive dissipation, which naturally lower general bodily resistance, play some part. It must be admitted, however, that a man who cannot do these simple things without precipitating a relapse is in no way free of his malaria. A sufficient period of observation in a carefully selected climate and altitude will provide the correct answer.

2. *The psychologic factor*.—To some patients the thought that they have malaria and that they probably will continue to have it for years creates an unhealthy mental attitude. This is a very real problem. These men have had so many relapses and have seen so many more among their immediate numbers, that their outlook is naturally depressing. Many have been more thoroughly impregnated with this thought by the fact that they were denied promotions, and entrance into special training schools or into aviation. In many cases they have been assigned to "casual companies" where the duty is uninteresting and boresome. Men returned to these companies under ambulant treatment with light duty are denied shore liberty. There is a shifting to and from these casual companies and the sickbay which is not conducive to good morale or to a speedy recovery.

3. *Escape from combat*.—These men have learned that men sick with malaria cannot fight. Often a day or two before a transfer of personnel is to occur, there will be a sudden increase in the number of admissions with malarial chills. Some admit they stopped taking their medicine; others that they partook too freely of alcohol, knowing that it would precipitate an attack necessitating their entrance into the sickbay and thus avoiding transfer.

4. *Reluctance to take medicine as directed*.—This is possibly related to 3. It is also due to the increasing dislike for the medicine. We learned that the men could not be trusted to take their medicine. They would hide it in their pockets, throw it behind radiators or under mattresses or in the scuttlebutt and report that they had taken it. After weeks of explaining and trusting the patients and many treatment failures, it was found necessary to

have the corpsmen personally administer each dose and carefully observe the patient until it had actually been swallowed. Medicine call for patients receiving ambulant treatment in this series was conducted by responsible corpsmen and supervised by noncommissioned officers.

5. *Inadequate courses of therapy.*—This applies to repeated insufficient courses both as regards dosage and length of time under treatment. A patient who has a relapse within 2 weeks after the last course of treatment has had insufficient therapy. We believe this may also be an important factor in the repeated and frequent relapses. Symptomatic treatment for a few days during the acute attack and then discontinuance of therapy until the next attack has, in our observation, been entirely ineffectual. Either this group of patients has very little natural immunity to this strain of plasmodium or their immune response is very slow. The proper amount of therapy over a sufficient period of time reasonably to assure a cure, would, it is believed, save valuable time and medicine. From a clinical and laboratory standpoint very little progress has been made on this group of men under the numerous attempted methods of treatment they have thus far received.

LABORATORY EXPERIENCES

An attempt has been made at this laboratory to accumulate as much data on this series of patients as conditions permitted. The exigencies of war have precluded the possibility of leisurely and detailed observations such as might be undertaken in time of peace. However, much work has been done aside from merely reporting the presence or absence of plasmodia. Some of the results seem worthy of presentation, particularly because certain aberrations from the usual recorded findings have appeared.

Our policy has been that of pursuing one line of investigation if it gave results which appeared to be of significance. If not it was discarded in favor of concentration upon some other approach to the problem. The importance of investigating the problem as thoroughly as possible lay in the fact that these 250 cases represented a portion of the first group of Marines who had to be returned to the mainland because of recurrent malaria.

It was decided that a brief history would be taken at the laboratory in conjunction with the technical procedure. This included only information concerning the date of the first attack, the place where it occurred, the total number of attacks, the date of the last attack and a summary appraisal of the treatment which

had been rendered. For this reason the laboratory data include certain clinical considerations.

Established technics were employed. Thick and thin blood films were made on every patient. Giemsa stain was used in a 1:30 dilution of concentrated stock solution as prepared at the Naval Medical School. The suggested 1:50 dilution did not seem to give as distinct a nuclear-cytoplasmic differentiation as the more concentrated stain. On completion of staining (45 minutes) the flooding of slides with buffer solution was found to enhance the quality of the staining.

Varying numbers of blood counts, differentials, sedimentation rates, and stool examinations were also done.

Erythrocytes.—Total counts on 102 patients gave an average of 4.1 millions per cubic millimeter. Only 3 cases dropped to the 3-million level. Hemoglobin determinations in 44 instances paralleled the erythrocyte level so closely, the average color index being 0.93, that they were abandoned. Morphologically the red blood cells showed no significant departure from the normal, except in one instance in which there was a profound and unusual type of poikilocytosis. The limiting membrane of the cells appeared to have ruptured at focal points with resultant extrusion of masses of the stroma. This finding was considered a rare but not serious consequence of intravenous quinine therapy. Therapy was continued with the result that after several subsequent doses the cells regained normality and began to increase in number. In general, the size, shape, and color of the erythrocytes in these cases did not show remarkable variations. Stippling was rarely encountered.

Leukocytes.—Total counts were taken on 124 patients during the rigor. The average count was 6,336. The transient leukocytosis mentioned by Coggeshall (1) and Manson (2) was a rare occurrence in this series. Only 7 patients exceeded the 12 000 level, the highest count recorded being 14,100. Fifty-nine leukocyte counts performed on completion of therapy showed a slightly higher level, 8,234. Many hovered about the lower range of normal, the lowest observed being 3,750.

Differential counts.—Two hundred determinations gave the following average: Band forms 2.2 percent, segmented neutrophils 64.6 percent, lymphocytes 28.1 percent, eosinophils 3.2 percent, and monocytes 1.9 percent. Plasma cells, Türk cells, and basophils were infrequently seen. Certain of our findings deviated from the usual recorded observations. They were:

1. Monocytosis was not encountered. Large mononuclear leukocytes were seen frequently but their cytoplasm was blue and

devoid of characteristic monocytic granules. These cells were unmistakable large lymphocytes. Monocytosis was not characteristic of malaria in this series.

2. The usual range of eosinophils was 0.0 to 9.0 percent. This type of cell was more numerous on completion of therapy than during the chill, at which time it was usually absent. One case presented an eosinophilia of 46 percent. Stool examinations revealed this patient to be harboring *E. histolytica* cysts. Eleven other patients registering a 12-to-26-percent eosinophilia were shown to have intestinal parasites, one showing giardia, 2 hookworm, and 8 *E. histolytica* cysts. Among the milder eosinophilias were 5 cases of filariasis. Evidently eosinophilia is not a feature of some types of malaria.

3. In many smears the polymorphonuclear leukocytes showed a wide maturity spread as evidenced by the same smear often showing a moderately high band count and simultaneously a large number of hyperlobulated forms. Five, six, and seven-lobed polymorphonuclear leukocytes were often seen. A striking example was one specimen which showed 11 percent band forms and 2 percent juveniles, yet 26 percent of cells containing 5 to 7 lobes. This probably denotes an irritable hematopoietic system; however no other infection or toxemia, to our knowledge, presents such findings.

4. Relative neutrophilia was present in about 30 percent of cases, lymphocytosis in less than 4 percent. A normal differential count was usual.

5. Rarely was hemozoin pigment seen to be engulfed by monocytes. Only in two instances were such pigment inclusions seen within polymorphonuclears. When present the characteristic yellowish brown color of this pigment is seen readily in thick drop preparations.

Sedimentation rates.—Although only a few sedimentation rate tests have been done so far, a significant trend is appearing. The sedimentation rate apparently increases in proportion to the parasitic density. The range was 4 to 24 millimeters in 60 minutes, the most rapid rates occurring in those cases showing a heavy parasitemia. This was especially true when the parasites were in the later stage of maturation.

Parasitic morphology.—One hundred percent of cases were of the *P. vivax* type. Information from observers in the field (3) where these infections were contracted, and the health records of the patients indicate that many of these men were infected with *P. falciparum*. Yet not a single case observed here has shown *P. falciparum*. This point can be emphasized because we have never at-

tempted a species diagnosis on ring forms alone. The more mature forms, schizonts, and gametocytes have always been demonstrated. Such forms are readily classified with a minimal percentage of error.

Certain deviations from the usual picture of *P. vivax* were found. Most notable was the frequent observation of multiple infected cells. Double rings have been seen in many smears, triple rings in occasional ones, and four rings in a single cell have been seen five times. This is an accepted characteristic of *P. falciparum* trophozoites. Its presence in *P. vivax* malaria is termed a rare occurrence by most observers. It might be said that this is evidence of mixed vivax and falciparum infections in our series. However in no instance have these forms even approached the morphology of the much smaller *P. falciparum* trophozoites. On the other hand typical vivax forms have been demonstrated in each case. The frequent occurrence of these multiple rings suggests one of two possibilities. Either this strain of *P. vivax* is more aggressive than the usual strain, or the individuals observed have been incapable of mustering the average degree of immunity.

The young trophozoite is accepted as the probable precursor of the adult gametocyte but the intermediary forms are not described in accepted works on malaria. In our opinion intermediary forms can be recognized. Plasmodial forms have been observed showing the following progressive changes: (1) A large chromatin mass surrounded by a halo limited by a thin line of blue cytoplasm which is, in turn, continuous with a round or ovoid ring possessing about one-eighth to one-fourth the amount of cytoplasm seen in a mature gametocyte; (2) a further increase in the amount of the cytoplasm which now shows heavy pigment deposition; (3) further filling out of the internal portions of the ring eventuating in the mature gametocyte.

The nuclear pattern as portrayed by Stitt (4) has been of more help to us in differentiating male and female gametes than have been the cytoplasmic differences emphasized by Coggeshall. A pale red, fragmented, nuclear mass which blends intimately with the surrounding parasite indicates the male form. If the nucleus is solid, deep red, and surrounded by a halo it is classified as a female gametocyte.

Parasitic density.—In this series parasitic density is classified only as 1 to 4+ in accordance with the recommendations of the International Malaria Commission. This is based, of course, on the average number of parasites per oil immersion field on thick-drop preparations. We are now making actual counts per unit of blood by using a known volume of blood and spreading it over a

circle of measured area. By calibrating the microscope it is possible to make a more accurate count than by using the parasite-erythrocyte count ratio. The method will be offered in detail in a future publication.

This method is apparently more accurate than orthodox methods of performing parasite counts and definitely less tedious. The parasite count has been over 20 percent higher by this method when compared with counts depending on the red blood cell: parasite ratio. It seems possible that delicate plasmodia are not visible in fixed smears if they are attached to the underside of the red blood cell.

The following observation is noted here because we have seen no mention of it elsewhere. Several times while examining hanging drop preparations of malarial blood, certain motile forms were observed free in the plasma. They were rod-shape and possessed a highly refractile spherical body which was capable of shifting its position from one end of the rod to the other. These motile bodies seemed to be attracted to red blood cells and apparently were attempting to pierce them. On impact with the cell the rod would split in its long axis, the two resultant portions ballooning out to form a perfect ring. No such forms ever were seen actually to penetrate the cell, but it is possible that these forms represent merozoites liberated from ruptured red blood cells. Failing in their attempted penetration they must seek a hiding place before they can reappear as a sufficiently potent trophozoite to initiate a new cycle.

COMMENT

The cases described here are chronic relapses, benign tertian in type. One striking fact has been demonstrated in over 90 percent of them; namely, that a very low parasitemia is capable of producing a severe rigor. The figure has been as low as 9 parasites per cubic millimeter of blood. The one-plus level has been definitely the popular density on smears examined during the phase of chill. More significant is the finding that no appreciable gain in the parasite level has been observed while studying successive relapses in the same individual.

This is in marked contrast to the findings in natives inhabiting malarious areas who frequently are shown to harbor a tremendous number of parasites with no clinical manifestations. Even in our forces at this comparatively early date many cases with parasitemias but no clinical disease have been reported. These men apparently are handling their infection well. But it appears that the

group described here is composed of individuals notoriously lacking in the ability to acquire an adequate degree of immunity.

Because this group has reacted so poorly to one strain of malarial plasmodia it would seem reasonable to assume that it would react equally poorly when exposed to other strains. Therefore the advisability of returning these men to areas where malaria is endemic should be seriously questioned. A reliable yardstick for predicting whether such groups would become a military asset or liability is yet to be established.

Regarding therapy, certainly these cases are added evidence that we do not have as yet any drug or combination of drugs adequate for coping with the malaria problem. It is fortunate in view of the quinine shortage that atabrin is available. This drug has a meritorious record in malignant tertian malaria. However its efficacy in the benign tertian type is considerably less. In the type of case presented here it has failed miserably.

It cannot be said that the atabrin failure is due to insufficient dosage. The amount of atabrin this group received is far in excess of the recommended 0.1 gm. 3 times a day for 5 days. These patients were all returned to this activity for active duty following a very adequate course of atabrin therapy and repeatedly negative blood smears before their discharge. It is equally true that they all had previously had quinine administered but not in sufficient amount nor over a long enough period of time to constitute a rigid therapeutic test.

In these cases the data indicate that quinine in large dosage has been markedly more effective. It is our opinion that the quantity of quinine we still possess should not be dribbled away in the process of routinely administering small doses in the usual cases of malaria but should be conserved for heroic treatment in those cases where atabrin has failed. The standard textbook dosage recommended wastes valuable quinine and increases the number of sick days. Our experience indicates there is little gained by the combination of atabrin and quinine. The routine use of plasmochin has little evidence to support its continued administration. All patients in this group had plasmochin previously with no apparent effect on the relapse rate.

The ideal drug for eradicating plasmodia, particularly the latent form recently termed the cryptozoite (5), may well be found to be a colloidal plasmodicide having a special affinity for the reticulo-endothelial system. At this writing such a compound has been evolved by combining high molecular pectin solutions with various soluble plasmodicides. Toxicity studies are promising but as yet no opportunity for using the substance in experimental

malaria has been afforded. We recognize that such a drug could not be used routinely. However we have seen so many days of duty lost by poor responders to present therapy that if one had at hand a substance capable of eradicating the cryptozoites a very great deal obviously could be accomplished.

SUMMARY AND CONCLUSIONS

1. A series of 250 cases of benign tertian malaria from the Solomon Islands is reported. These cases all have a high relapse rate.

2. A much better response to quinine than to atabrin therapy is shown in these relapsing cases. Quinine in large dosage, with occasional intravenous use, has given consistently good results.

3. The combination of quinine and atabrin in routine therapy is unwarranted. The quinine that we still possess should be conserved for use in certain types of cases only. Atabrin in greatly increased dosage was found ineffective in this group of patients. Routine administration of iron, arsenic, or vitamins, although of value symptomatically, is in no way curative.

4. Variations from the usually encountered reports on *Plasmodium vivax* malaria have been observed during laboratory studies.

5. A substance having an affinity for the reticulo-endothelial system is presented. Toxicity studies are encouraging but no appraisal of its possible antimalarial value is possible at this time.

6. Prompt evacuation to a malaria center and controlled intensive treatment for a sufficient period of time would effect more recoveries and reduce the number of sick days.

REFERENCES

1. COGGESHALL, L. T.: War malaria. *M. Clin. North America* 27: 617-631, May 1943.
2. MANSON-BAHR, P. H.: *Manson's Tropical Diseases*. 11th edition. Wm. Wood & Co., Baltimore, 1940.
3. TALBOT, D. R.: New aspects of malaria. *J.A.M.A.* 123: 192-194, September 25, 1943.
4. STRONG, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases*. 6th edition. Vol. 1. The Blakiston Co., Philadelphia, 1942.
5. HUFF, C. G.; COULSTON, F.; and CANTRELL, W.: Malarial cryptozoites. *Science* 97: 286, March 26, 1943.

AIR EMBOLISM IN IMMERSION BLAST

FRANK J. GOUZE

Lieutenant Commander (MC) U.S.N.R.

and

ROBERT HAYTER

Lieutenant (MC) U.S.N.

In the reports of experimental blast injury by Greaves and his coworkers (1), Friedell and Ecklund (2), and others, the description of pulmonary pathology closely resembles that given by Polak and Adams (3) in their study of experimental traumatic air embolism and by Behnke (4) in his analysis of air embolism accidents occurring in training with the submarine "lung." In both blast injury and air embolism the lungs are hemorrhagic and emphysematous; microscopy reveals rupture of the capillaries, hemorrhage into the alveoli and interstitial tissues, and disruption of the alveolar septa (emphysema).

With these facts in mind experiments were carried out to determine whether air does enter the circulation in blast injury to the lungs, and if it does, what part it plays in the sudden death observed in severe blast injury.

Method.—One guinea pig and nine rabbits were used. The animal was placed in a coarse-mesh wire cage, immersed up to its neck in water and subjected to a blast from a 65-grain fulminate of mercury detonating cap placed in the water 4 to 11 inches from the sternum, the distance being varied in order to alter the period of survival.

Observations.—The guinea pig died in 20 seconds, and two rabbits lived a relatively long time, one 9 minutes and the other 40 minutes. The other rabbits lived 1 to 2 minutes.

The following was the typical premortal syndrome. The animal was incoördinate, collapsed, lay on its side, squealed and gasped; bloody froth issued from the nostrils, the extremities twitched, opisthotonos appeared, and the heart, although irregular, beat one-half to one minute after breathing stopped.

Postmortem examination revealed lung damage characteristic of blast; namely, crepitant but very hemorrhagic tissue. When a rabbit is killed by a blow on the head, and the thoracic cavity is opened the lungs collapse and are seen to fill about a third of the cavity. The lungs of a rabbit killed by blast are not collapsed and

almost completely fill the thoracic cavity; although they are large they are spongy and float high when placed in water.

A common finding was mediastinal emphysema. Two animals had blood in the pleural cavities. Two animals had air in the pericardial sac. No skull fractures or intracranial hemorrhages were observed. All the brains had normal color and consistency.

To insure that no air was overlooked the vessels attached to the heart were ligated, severed distal to the ligatures, and the cardiac chambers, pulmonary artery, pulmonary veins and sinus venosus were opened under water. The remainder of the autopsy consisted in inspection of the larger vessels of the abdomen, extremities, and neck, and a careful removal of the skull cap to examine the vessels of the brain.

Air was found in the circulatory system of eight of the animals. All these animals had air in the vessels of the brain. One animal had air in the coronary and brain vessels; two had air in the brain vessels only; and three had air in the coronaries, brain vessels, and left auricle and ventricle. In three there was also air in the superior vena cava, pulmonary artery, pulmonary veins, and right auricle and ventricle. One of these three animals lived 40 minutes and was carried about in various positions; it had air also in the inferior vena cava, renal veins, and veins of the extremities.

Van Allen and his coworkers (5) studying air embolism in dogs, found that the position of the animal's body determined the distribution of the air. Even in circulating blood, air retains its buoyancy and so travels to the highest part of the body. Our animals were blasted with their heads uppermost. Van Allen showed that when the animal was vertical, air was distributed only to those parts of the body lying above the level of the heart. This explains why all our animals in which air was found had air in the vessels of the brain. Only in the animal that lived 40 minutes and was carried about in various positions was air found below the level of the heart.

COMMENT

Greaves and his associates state that when a compression wave greater than 500 pounds per square inch strikes the body it is transmitted through the tissues and, upon striking the air within the lungs, breaks through into the gaseous medium with a shredding effect. The compression wave blows off the surface of the tissues in the same manner as it blows off the surface of the water when it breaks through into the air. The delicate alveolar

septa are damaged by a very slight shredding action. Since the capillaries are the most vulnerable tissue in the septa, they alone may be injured. When the compression wave greatly exceeds 500 pounds per square inch, the alveolar septa are torn and traumatic emphysema is produced.

In fatal blast, disruption of the lung tissue probably alters respiration and circulation. Tearing of the capillaries and destruction of the alveolar walls would interfere with respiratory function; that is, with oxygenation of the blood and elimination of carbon dioxide. Another result of the injury to the capillaries would be that, although the right ventricle continued to pump blood into the lungs, little blood would reach the left ventricle. The reduced output of the left ventricle would cause the systemic blood pressure to fall; the arterial circulation would become sluggish and hypoxia would occur.

As mentioned, when the chest is opened at autopsy the lungs do not collapse. Apparently rupture of alveoli and bronchioles traps the air. Very few bronchi contain clots; when the sectioned lung is squeezed a bloody froth exudes from the cut surface. This suggests that disruption of the alveoli rather than plugging of the bronchi with clots keeps the lungs inflated even after death. We believe it is highly probable that the emboli come from alveolar air that has entered the interstitial tissue; being unable to escape into the bronchioles it is picked up by the pulmonary veins and is carried to the heart. It may be that some of the torn pulmonary tissue acts as flap-valves which allow air to enter the alveoli during inspiration but prevent its leaving during expiration, thereby causing a progressively increasing emphysema. The blast may also produce a bronchovenous fistula (5) that would allow air to enter the veins during inspiration.

The pressure in the pulmonary veins is ordinarily near the zero level—from minus 3 mm. water in inspiration to plus 4 mm. water during expiration. Owing to the reduction in intrapulmonic pressure during inspiration air could enter the circulation; as previously mentioned, this passage into the veins would be encouraged by the trapping of air in the damaged lungs.

Small emboli can be tolerated by the body and may account for the milder symptoms which have been occasionally seen after the induction of artificial pneumothorax or during training with the submarine "lung." The severe and fatal cases occur when massive air emboli lodge in the vital areas, especially the respiratory center or the coronary vessels. Since in most of the reported cases of air embolism the person is in the head-up position, emboli usually go to the arteries of the brain; therefore neuromuscular

symptoms are common. These symptoms are fainting, paresthesia, aphasia, anesthesia, and visual disturbances; the more serious symptoms are unconsciousness, hyperpnea, convulsions, and irregular breathing. A paralysis sometimes persists after the graver symptoms have disappeared. If death occurs it is usually within 6 days.

Van Allen and his coworkers found that when their dogs were in the head-up position few emboli entered the coronaries. When they were in the head-down position the coronaries contained many emboli and the vessels of the brain no emboli, and the dogs showed cardiovascular symptoms such as irregular pulse, low blood pressure, and gradual or sudden heart failure. When a large amount of air was injected in a pulmonary vein, there was early and complete heart block. A smaller amount caused dropped beats (partial block).

When dogs were in the horizontal position both cardiovascular and neuromuscular symptoms appeared and were in varying proportions, but the neuromuscular usually predominated.

The fatal effects of air embolism from the pulmonary vein were due to impairment of three vital functions: (1) Cardiac activity by the obstruction of the coronary arteries; (2) cerebral and medullary function by obstruction of the arteries of the brain; and (3) circulation of blood by obstruction of the pulmonary arteries. Either the first or the second was the primary cause of death; the third was never more than contributory. The first was the sole cause of death when the animal was in the head-down position, and the mechanism was heart block. The second was the sole cause of death when the animal was head-up, with respiratory paralysis in the early stage or decerebration later. In the horizontal position all three contributed and the first or second was primary, depending on the chance distribution of the air emboli.

The tolerance of these dogs for air injected into the circulation depended largely on the portal of entry. In the jugular vein or descending aorta more than 50 times as much was tolerated as in the pulmonary vein. In the pulmonary vein, tolerance depended on the position of the body; it was least in the head-up position, 3 times as great in the horizontal, and $6\frac{1}{2}$ times as great in the head-down position.

Anent immersion blast, the conclusion is that early death is due to lung damage (hemorrhage and emphysema) which (1) reduces aeration of the blood, (2) reduces the output of the left ventricle by interfering with the flow of blood in the pulmonary vessels, and (3) causes air embolism. It is likely that in every

early death hypoxemia and poor left ventricular output occur, and that in many but not all the early deaths air embolism plays an important role.

Reports of cardiac and neurologic examination of human victims when first seen would be of great value, and, in those dying shortly after the blast, immediate autopsies with careful search for air emboli.

Immersion blast and air blast produce identical pulmonary lesions. Therefore it is reasonable to assume that air embolism could occur also in air blast.

TREATMENT

From Boyle's law we know that bubbles in blood vessels will become smaller as the pressure in an air chamber is raised. In air embolism, in contrast to bends, the bubbles will readily go into solution, for the nitrogen pressure in the blood and tissue does not exceed the atmospheric nitrogen pressure. The flow of blood to the tissues becomes adequate; that is, symptoms of embolism disappear, when by compression the bubbles dissolve or become small enough to leave their place of lodgment and pass into the veins.

It seems that since air can enter the circulation it would be valuable to try air-chamber compression of human victims, particularly those with neurologic involvement or with evidence of poor coronary circulation; namely, hypotension and irregular heartbeat. Even though some of the patients with neurologic signs or symptoms could not be compressed until a day or two had passed, compression would be worth trying. Behnke (4) reported a shallow-water diving accident in which the patient had air embolism followed by convulsions for two days and was then cured by treatment with compressed air.

Compression would also reduce the volume of air trapped in the interstitial areas of the lungs. This would improve pulmonary circulation by reopening intact pulmonary capillaries collapsed by the trapped air. Although reducing the volume of trapped interstitial air might increase bleeding from torn pulmonary vessels, it would seem that advantages obtained from compression of patients exhibiting cardiovascular or neurologic symptoms would outweigh this undesirable result.

Because of (a) disruption of the alveolar walls and (b) air emboli in the pulmonary vessels, some of the hemoglobin passing through pulmonary capillaries would be only partly oxygenated. Compression increases the partial pressure of oxygen and the

other gases in the air; the resultant increase in oxygenation of the hemoglobin would reduce the hypoxia of the tissues. Further, the increased partial pressure of oxygen in the inspired air would increase the amount of oxygen in physical solution in the plasma.

Oxygen should be used in blast injuries, for it would improve the oxygenation of blood flowing through the damaged lungs.

Another advantage is that oxygen seems to reduce the size of the emboli. Fine and Fischmann (6) found that it relieved symptoms of air embolism. They produced paralysis in rabbits by injecting air into the right or left carotid artery. When 90- to 100-percent oxygen was breathed for 1 to 2 hours immediately after the injection of air, the paralysis was less in from 1 to 3 hours and disappeared within a day. In control rabbits, the paralysis did not disappear in less than from 5 to 14 days.

They believed the more rapid recovery of function by the nerve cells of the rabbits that were given oxygen was not adequately explained on the basis of a greater oxygen saturation of the brain, for the oxygen deficit produced by the air embolus was probably far greater than could have been compensated for by an increase in diffusion of oxygen from the adjacent tissues.

They concluded that oxygen was beneficial because it reduced the pressure of the alveolar nitrogen so much that the nitrogen in the blood rapidly diffused into the lungs. As a result the emboli, which were mainly nitrogen, became smaller and finally disappeared.

If compression were used 100-percent oxygen could be started at the 60-foot level and could be continued even after the termination of compression in the chamber. A discussion of the way in which oxygen is used in the pressure chamber may be found in the paper by Yarbrough and Behnke (7).

Since oxygen is apt to irritate the pulmonary epithelium it should be stopped as soon as the patient is comfortable without it. Consequently, after the treatment in the chamber is concluded, one should intermittently discontinue the use of oxygen and observe the patient to determine if he remains free of dyspnea, cyanosis, and symptoms of air embolism.

Artificial respiration should not be used, for it would probably increase pulmonary bleeding and also might force air into the pulmonary veins. The giving of plasma would increase pulmonary hemorrhage and edema.

SUMMARY

1. Autopsy findings in animals subjected to fatal immersion blast are presented.

2. Air embolism of varying degree was frequently observed.
3. The symptoms caused by air embolism are discussed.
4. It is believed early death in blast is caused by (a) air embolism, (b) reduced respiratory function, and (c) insufficient flow of blood from the left ventricle.
5. Data from autopsies on human victims dying soon after blast are needed.
6. It is suggested that victims of blast injury be compressed in an air chamber.

REFERENCES

1. GREAVES, F. C.; DRAEGER, R. H.; BRINES, O. A.; SHAVER, J. S.; and COREY, E. L.: Experimental study of underwater concussion. U. S. Nav. M. Bull. 41: 339-352, March 1943.
2. FRIEDEL, M. T., and ECKLUND, A. M.: Experimental immersion blast injury; preliminary report. U. S. Nav. M. Bull. 41: 353-363, March 1943.
3. POLAK, B., and ADAMS, H.: Traumatic air embolism in submarine escape training. U. S. Nav. M. Bull. 30: 165-177, April 1932.
4. BEHNKE, A. R.: Analysis of accidents occurring in training with submarine "lung." U. S. Nav. M. Bull. 30: 177-185, April 1932.
5. VAN ALLEN, C. M.; HRDINA, L. S.; and CLARK, J.: Air embolism from pulmonary vein; clinical and experimental study. Arch. Surg. 19: 567-599, October 1929.
6. FINE, J., and FISCHMANN, J.: Experimental study of treatment of air embolism. New England J. Med. 223: 1054-1057, December 26, 1940.
7. YARBROUGH, O. D., and BEHNKE, A. R.: Treatment of compressed air illness utilizing oxygen. J. Indust. Hyg. & Toxicol. 21: 213-218, June 1939.



PENICILLIN IN ECZEMA

For the most part the patients treated were resistant cases of chronic eczema in which it seemed that elimination of secondary infection might aid recovery. All were treated with sodium or calcium penicillin in the lanette wax and petroleum jelly base, 400 units per g.

It is possible that improvements as occurred in this series were due to the lanette base rather than to penicillin. There is little doubt, however, that in two cases the dramatic improvement was the result of controlling the infection, and the limited success in two others is in agreement with this. Penicillin should be worthy of trial in cases of eczema with evidence of secondary infection.—ROXBURGH, I. A.; CHRISTIE, R. V.; and ROXBURGH, A. C.: Penicillin treatment of certain diseases of skin. Brit. M. J. 1: 524-528, April 15, 1944.

ADHERENT SCARS OF THE LOWER EXTREMITY

GEORGE V. WEBSTER

Lieutenant Commander (MC) U.S.N.R.

The scars on a lower extremity which most frequently require plastic or reconstructive surgery are of two general types: (1) Massive surface defects, such as second- and third-degree burns, with their late complications, including contractures about the joints; and (2) smaller, but deeper, scarred areas which are adherent to the underlying structures such as tendons, bone, deep fascia, etc.

The size of the defect and the obvious deformity in the first type have led to early recognition of the necessity for plastic or other reconstructive procedures. The grafting of third-degree burns by "small-deep" or "split-thickness" grafts can be done by the general surgeon attending the patient. The release of later contractures and resurfacing of thinly scarred areas belong more definitely in the specialized field of the plastic surgeon, but even these procedures have become fairly well standardized.

Adherent scars of the lower extremities present an immediate appearance which masks their potential late complications. Such scars result from deep burns, penetrating missiles, or crushing injuries of various types and are particularly common in military practice. Loss of substance is frequent and, in the case of compound fractures of the lower extremity, adequate local covering may be entirely lacking.

Such areas may heal spontaneously by scar epithelium while the patient is in bed, and it is only after resumption of normal ambulatory activity that ulcerated areas may appear and become progressively worse until the patient is again put to bed. Healing will then take place as promptly as before, but the scar may ulcerate again when the patient allows the part to become dependent in position. The slightest trauma may produce a scratch which fails to heal and soon becomes an ulcer. This chain of events, sometimes extending over many weeks or months, goes on until the patient in many instances is a chronic invalid (fig. 1A). In any event the loss of time from active duty may be enormous.

Other disabilities occur when scars are adherent to tendons, especially near joints, for here the excursion of moving parts is limited and release is necessary for resumption of full function

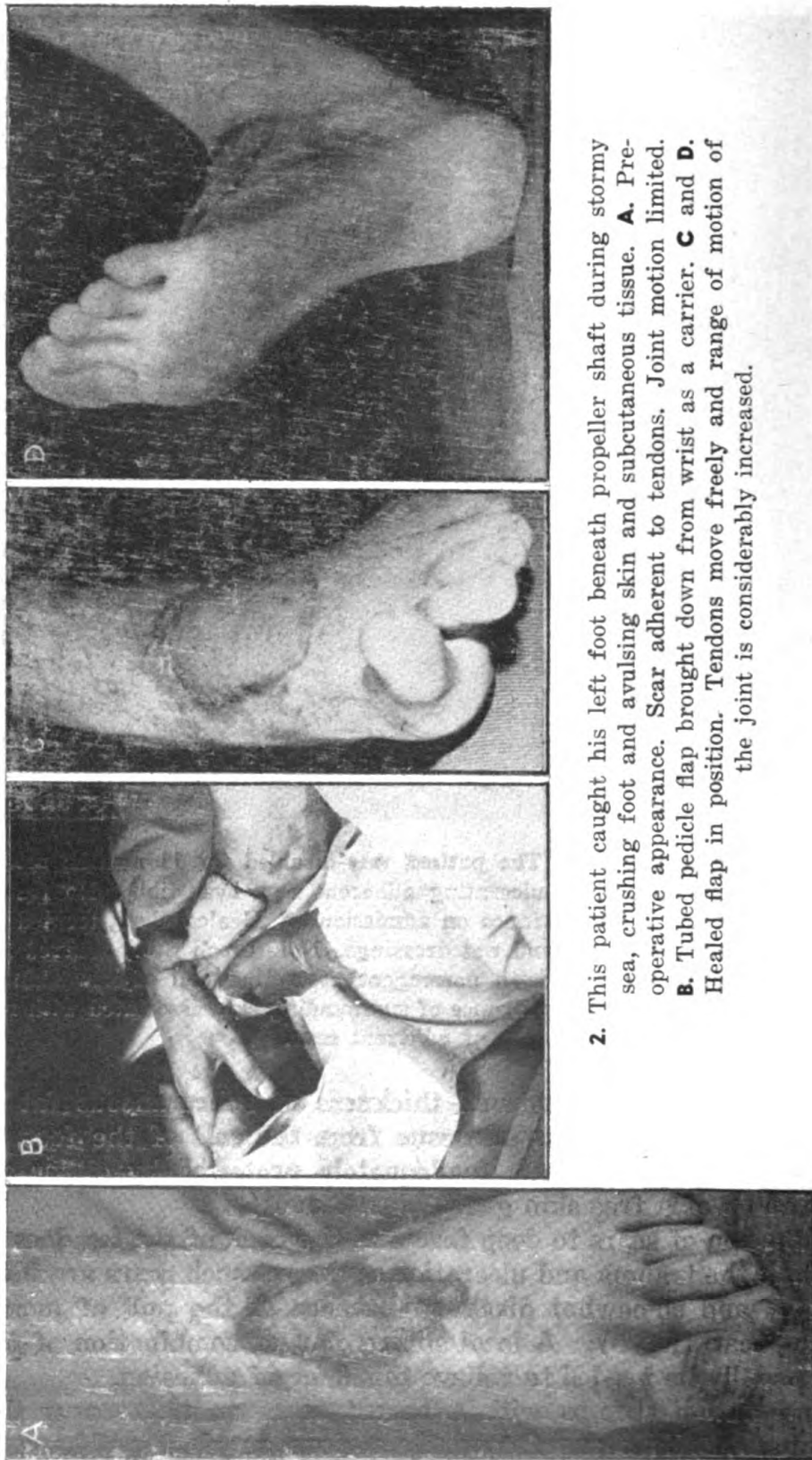


1. Shell fragment wound. The patient was disabled for 11 months prior to admission, because of ulcerating adherent scar over tibia. No fracture was present. **A.** Appearance on admission. **B.** Healed ulcer, treated only by bed rest, elevation and wet dressings. Note broad shiny scarred area. **C.** Complete recovery with permanent protecting pad of new skin and fat. Note improved appearance of surrounding skin associated with relief of adherent scar.

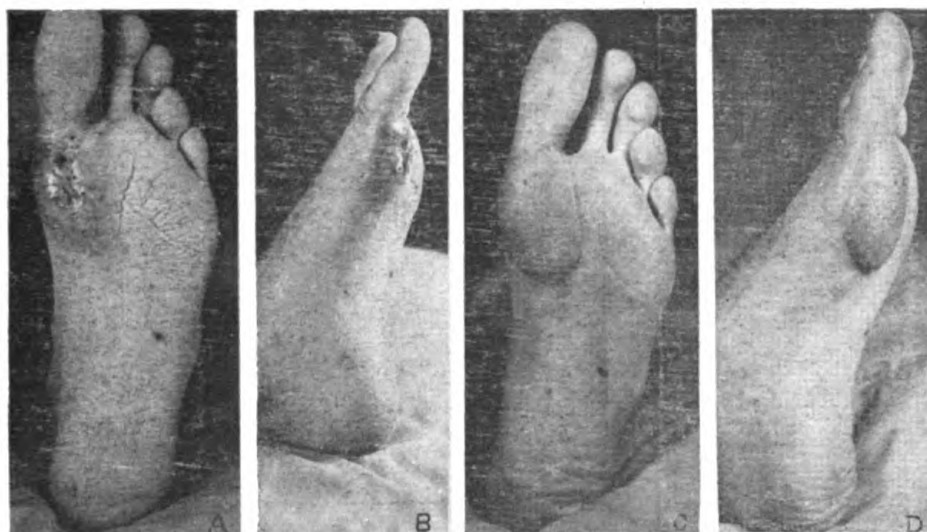
(fig. 2). Unless an unusual thickness of subcutaneous fat has remained following loss of tissue from the sole of the foot, the weight-bearing surface is inadequately protected by either scar epithelium or a free skin graft (figs. 3 and 4).

Adhesion of scars to deep fascia at the back of the leg does not produce the trauma and ulceration cycle, yet such scars are inconvenient and somewhat disabling because of the pull of muscles on the scar (fig. 5). A local sliding flap or combination of flaps will usually be needed to relieve this type of adhesion.

Amputation stumps with adherent scars or ulcers over their terminal portions are frequently serious surgical problems. A flap obtained from the other leg or from some distance away may prevent sacrifice of further bone and preserve the usefulness of



2. This patient caught his left foot beneath propeller shaft during stormy sea, crushing foot and avulsing skin and subcutaneous tissue. **A.** Pre-operative appearance. Scar adherent to tendons. Joint motion limited. **B.** Tubed pedicle flap brought down from wrist as a carrier. **C** and **D.** Healed flap in position. Tendons move freely and range of motion of the joint is considerably increased.



3. Plantar wart treated with x-ray several months before entry into the service. Area ulcerated following trauma of normal weight-bearing. Local excision and attempted closure added to the damage. The patient was disabled for 9 months. **A** and **B**. Preoperative appearance, typical of x-ray burns in this region. **C** and **D**. Appearance following return to duty. Satisfactory weight-bearing surface has been restored.

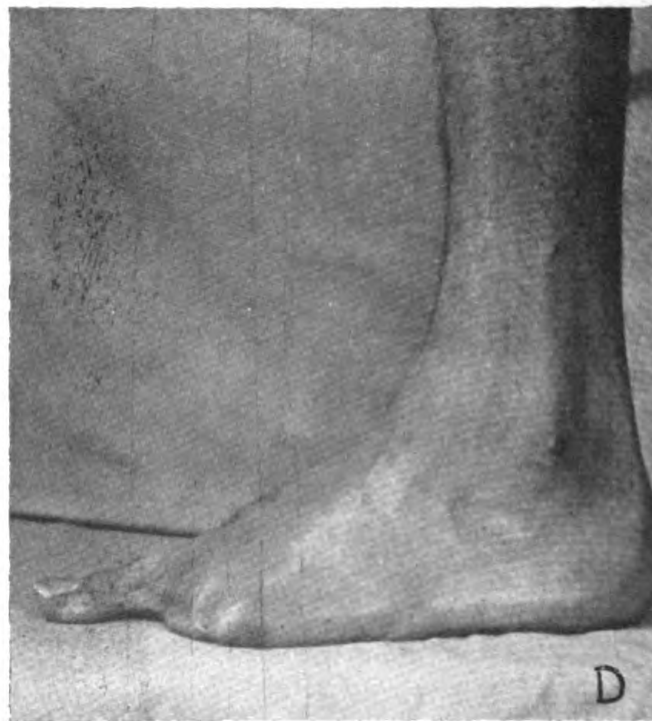
the stump in rare instances, although it is not recommended for the lower leg.

PHYSIOLOGY AND PATHOLOGY

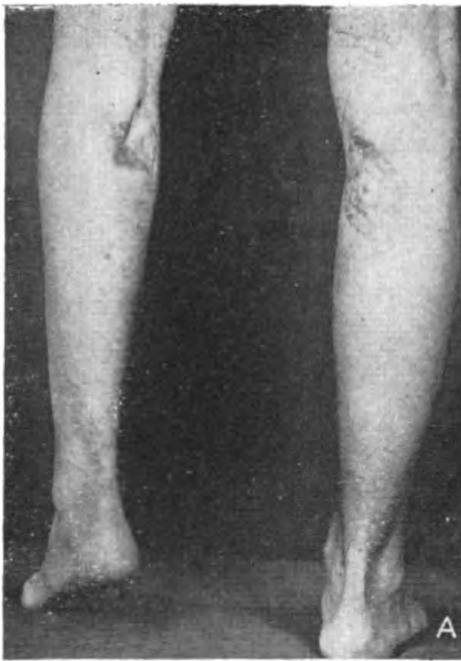
The circulatory balance of the lower extremities varies largely with postural changes. In the uninjured leg a period of bed rest for only a few days results in impaired venous and lymphatic return when the erect posture is resumed. This is evidenced by bluish congestion of the veins of the leg and especially of the dorsum of the foot and is frequently accompanied by edema. It is prevented only by gradually lowering the leg to the completely dependent position, and alternating with the elevated position until the venous and lymphatic return are again well established. Supportive bandages are also of value here.

This "decompensation" of the circulation of a lower extremity is an interesting phenomenon. Since it occurs in so much less degree in the upper extremity, it is probably related in part to the differences in the anatomic components of the circulation of the upper and lower extremities.

The normal factors serving to preserve circulatory compensation in the dependent position are muscular massage of the deeper veins by the muscles in walking and running, and the competence of valves of the superficial and communicating veins. Somehow



4. This patient suffered a crushed anterior foot and traumatic amputation of toes from recoil of anti-aircraft gun. Painful ulcer developed over metatarsal area, prohibiting weight-bearing. **A** and **B**. Preoperative appearance. The patient was unable to bear his weight except on heel. **C** and **D**. Postoperative appearance. A good, painless weight-bearing surface has been reconstructed.



5. A shell fragment crossed both calves just below the popliteal fossa. The left leg wound was deep but on the right side subcutaneous fat was preserved. Both areas nicely covered by grafts primarily. Left leg graft has become adherent to fascia and scar over gastrocnemius and soleus muscles. **A.** Preoperative appearance. Left calf shows muscle contracture as well as adherent scar. Right leg graft satisfactory. **B.** Photograph taken at operation showing method of repair by shifting two local flaps. Donor sites of these flaps covered with thick-split grafts. A drain has been placed beneath the flaps. A good result was obtained.

the absence of the massage effect of the muscles when the patient is in bed, and the ease of venous return from an elevated limb, upset the balance and it is restored with difficulty.

In the presence of varicose veins, incompetence of the valves results in severe venous stasis and death of adjacent tissue. Ulceration occurs even in the absence of trauma. Here the weight of a column of blood as high as the right auricle, through the vena cava and the iliacs, bears down constantly against thin capillary walls. This produces an unwanted congestion with poor oxygen exchange, strangulation, and finally death of the deep tissue cells as well as those of the intact dermis. A varicose ulcer results.

In a larger measure the problem of circulatory balance has been investigated experimentally by Halsted and later by Reichert in relation to the replantation of an entire limb. It was found that arterial regeneration could be demonstrated as early as the second and third postoperative day, while venous anastomoses appeared at the end of the fourth and beginning of the fifth day. Lymphatic

regeneration was demonstrated approximately 4 days after operation.

When ligation of the femoral vein alone was done at the time of replantation, all of the experimental animals quickly developed gangrene, appeared listless and became toxic. Reichert says, "In the tissues of the replanted limb . . . large amounts of serous yellowish fluid, at times jelly-like, were found infiltrating the subcutaneous and muscular layers. The muscles of the replanted limb were swollen, lusterless and did not contract. Intravenous injections of small amounts of this yellowish exudate into a normal dog caused convulsions." It seems probable that this toxic substance is present in the transudate caused by the already established arterial supply in the absence of adequate venous return, and represents the accumulation in the tissue spaces of the noxious end-products of cellular metabolism and disintegration in the distal limb.

Something similar occurs in mild degree in the lower extremities of the bedridden patient when he first resumes erect posture; the pathologic picture of venous and lymphatic stasis results.

To show further the arteriovenous interrelationship, Lewis and Grant (quoted by Collens and Wilensky (1)) found that during a period of venous congestion produced by the application of a tourniquet, there occurred an increase in arterial amplitude in plethysmographic tracings. This demonstration further indicates that the presence of venous stasis has with it a component increase in arterial flow and results in embarrassing still further the local cellular metabolism by the production of a more marked congestive hyperemia.

This chronic passive congestion is demonstrated clinically by the purplish blotchy suffusion of the feet of a bed patient when he first stands beside his bed. Actual petechial hemorrhages occur if there is a recent scar or graft. Continuation of this congested state for more than a few minutes will result in the formation of blebs beneath the scar epithelium and frequently ulceration will occur within a few hours.

When, however, there is sufficient subcutaneous fat beneath the scar or free graft, this tendency for congestion is considerably less marked. Most of these patients, if put on a regime of gradual resumption of the dependent position, together with the use of supportive bandages, will regain circulatory balance in the lower extremity. It is because of this normal subcutaneous tissue that many free grafts on the lower leg are successful (fig. 6).

Homans (2) states that in the treatment of varicose ulcers, for example, an Ollier-Thiersch graft produces an adequate covering



6. This patient sustained an abrasion in a foxhole on Guadalcanal. An ulcer developed which failed to heal despite 13 months on the sick list as an ambulatory patient. **A.** Appearance before operation. Thin scar epithelium and granulation tissue overlies a bed of fairly normal subcutaneous fat. **B.** All ulcer and surrounding scar have been excised and defect covered with a thick-split graft which is entirely satisfactory.

if the ulcer is excised down to good underlying tissue and all varicosities have been treated by ligation or injection. As long as the underlying tissues remain soft and well vascularized, this use of a free graft is quite satisfactory. When venous stasis persists, however, or when there is insufficient subcutaneous tissue, ulceration rapidly recurs.

The thick-split graft, as advocated by Blair and Brown (3), and the three-quarter thickness graft recommended by Padgett are more durable and elastic than the thinner graft (Ollier-Thiersch) for surface defects. Thus, the thick-split graft is desirable in treatment of such defects as third-degree burns without destruction of the underlying tissue.

In the absence of subcutaneous fat and when a poorly vascularized scar is adherent to the underlying bone or tendons, the tendency toward recurrent ulceration has been mentioned. To these factors of congestion are added the loss of cushioning effect of the subcutaneous fat and the diminished arterial supply characteristic of scar tissue. Scar tissue is inelastic and cannot recoil



7. This patient developed two small furuncles on the right leg which were treated by local applications of tannic acid jelly. Five months of disability followed. **A.** Appearance before operation. Tissue destruction extended to the periosteum of the tibia, but the area was so small a free graft was thought worth trying. **B.** Both areas and surrounding scar were excised and thick-split grafts took well. Lateral area remained healed, but area over tibia soon ulcerated after patient was allowed up and about. This occurred in spite of supportive bandages and gradual resumption of activity. **C.** Local flap shifted to cover area and thick-split graft placed on donor site of flap. Excellent result. Note that smaller area on soft tissue bed has remained healed.

to protect itself against trauma. Thus it becomes necessary for adequate treatment in such cases to cover the scarred area with new skin and fat. This is also the only way of securing an adequate weight-bearing surface for the denuded sole of the foot, or of providing sufficient gliding covering for underlying tendons and joints.

Koch (4) states, "We know of no way of transferring subcutaneous tissue with its covering skin except by the use of a pedunculated flap." This is a well established plastic surgical principle and its proper employment provides the answer for the problem of adherent scars in the lower extremity.

The pedicle flap had an early origin but was popularized during

the last war. In spite of the established use of the pedunculated flap over a period of many years by plastic surgeons, many general practitioners and even surgeons still consider that the several operations required are too complicated and too formidable a series of procedures to inflict on any patient. This prejudice has allowed many recurring ulcerations of adherent scars to produce disabilities.

In Naval practice the youth and resistance of the majority of patients make procedures possible which would be denied an older age group. Joints can be immobilized as necessary without fear of permanent injury, and the general resistance of the younger patient is much higher. Then too, the economic status of the patient does not deter the surgeon in his decision to use the best method suitable for the treatment of a particular case.

Lesser, temporizing procedures may give an apparently satisfactory result in a young individual. Twenty years later, however, that individual may become invalided through disability derived from ulceration of a too-thin graft or untreated scar. In the long-range consideration of the patient's disability, it is therefore desirable to employ what might seem at first to be the more elaborate procedure.

TYPES OF PEDICLE FLAPS

The choice of pedunculated flap suitable for relief of a specific lesion depends on a number of factors, chief of which are size of the defect and availability of donor material. If the scar is small and overlies the tibia in its middle third, for example, a local flap may be utilized to cover this defect (fig. 7B and C). The area from which this flap was derived can be covered with a free graft which would lie upon a sufficiently soft bed of underlying tissue.

When the defects are larger, flaps may be taken from the uninjured leg either from the calf or thigh (figs. 3 and 4). Their position and choice will vary materially with the area for which they are intended. Defects of the sole of the foot are usually adequately replaced by flaps from the well leg, while those of the dorsum are more difficult to cover because of the peculiar angles at which a flap must be maneuvered.

Some cases may require a graft from a more remote region and this is particularly true of the larger defects. Tube pedicles or open flaps can be brought from the flanks or chest, using the wrist as an intermediate carrier (figs. 1 and 2). The older practice of "waltzing" pedicles end-over-end to reach an extremity has

been abandoned by most plastic surgeons in favor of the quicker and simpler use of the wrist as an intermediate carrier. Adherent scars of the back of the leg present a problem which is usually solved by local shifting of flaps and the use of free grafts to cover the donor areas (fig. 5).

Great care and patience are necessary for the success of such operations. Ill-conceived or hastily executed surgical procedures are fraught with dangers and disappointments which may easily result in a disaster from which the patient, and frequently the surgeon, can only recover with great difficulty. One must select patients carefully, plan procedures well and execute them with all the gentleness and skill which modern atraumatic surgery demands. Under such conditions, successes are the rule and the gratifying good results bring with them rehabilitation of the otherwise disabled.

REFERENCES

1. COLLENS, W. S., and WILENSKY, N. D.: Intermittent venous occlusion in treatment of peripheral vascular disease; experience with 124 cases. *J.A.M.A.* 109: 2125-2130, December 25, 1937.
2. HOMANS, J.: *Circulatory Diseases of the Extremities*. The Macmillan Company, New York, 1939.
3. BLAIR, V. P., and BROWN, J. B.: Use and uses of large split-skin grafts of intermediate thickness. *Surg., Gynec. & Obst.* 49: 82-97, July 1929.
4. KOCH, S. L.: Transplantation of skin and subcutaneous tissue to the hand. *Surg., Gynec. & Obst.* 72: 1, January; 157, February 1941.



PHENOXYTOL

Tests of the bacteriostatic and bactericidal values of ethylene-glycolmonophenylether, for which the name "phenoxetol" is suggested, showed that *Ps. pyocyanea* is particularly sensitive to it.

The compound might be used against pyocyanea infection in wounds, perhaps in conjunction with other antiseptics such as penicillin, the acridine compounds, the quaternary ammonium compounds and the sulphonamides, which have low bacteriostatic values against *Ps. pyocyanea*. Phenoxetol was found to be compatible with these other antiseptics.—BERRY, H.: Antibacterial values of ethylene glycol monophenyl ether (phenoxetol). *Lancet* 2: 175-176, August 5, 1944.

COMPLICATIONS FOLLOWING TATTOOING

SENSITIZATION AND DESENSITIZATION TO MERCURY REPORT OF A CASE

MARION B. SULZBERGER
Commander (MC) U.S.N.R.

ABRAM KANOF
Lieutenant Commander (MC) U.S.N.R.
and
RUDOLF L. BAER, M.D.

The chief sequelae of tattooing reported in the older literature were either the transmission of disease from the tattooer to his client, or the development of pyogenic infection owing to crude, nonsterile technic. The disease most frequently transmitted was syphilis. LaCassagne (1) in 1881 reported an instance in which a tattooer, who was later discovered to have mucous patches in the mouth, infected 9 victims in one day. Maury and Dulles (2) 7 years later reported an experience wherein 15 men developed chancres of the arm, in some instances multiple, as a result of tattooing. On examination, the tattooer presented mucous patches of the mouth, condylomas of the scrotum, and slight inguinal adenitis. He admitted the practice of moistening his needles with saliva. An additional example of syphilitic infection from tattooing has been reported by Cheinisse (3).

Several authors have pointed out that in their cases tattooing influenced the distribution of the eruption in secondary syphilis. To our knowledge the earliest observations of this effect were those by Dohi (4). Belote's (5) report is perhaps the best summary of opinion on this feature of the practice. Tattooing accentuates and localizes the secondary eruption because of its irritating effect; however in the red areas (cinnabar, mercuric sulfide) the antisiphilitic effect of the mercury is often greater than its irritating effect, and the syphilitic rash is locally inhibited. The result apparently depends on the factors of local lowered resistance or irritation and the local antisiphilitic influence of the mercury.

Tuberculosis also may be transmitted by careless tattooing. In 1895 at the Museum of Pathology of the British Medical Association, Hutchinson exhibited two boys who had developed tuberculosis of the skin following tattooing in which the needle had

been moistened with saliva (6). The same cases were later reported by Collings and Murray (7).

There have been only rare reports of direct pyogenic infection and other infections caused by the tattooing needle. Bercheron (8) in 1862 reported 43 such cases with 8 deaths. There were 8 cases of amputation and 7 of gangrene not treated by amputation; in 25 cases there was marked inflammation of the extremity, and there was one case of an arteriovenous aneurysm.

Since Bercheron's publication there have been no reports of this type of complication. Shie (1) states that leprosy and tetanus have been observed as complications and Madden (9) adds that erysipelas and chancroid are possible sequelae. Madden also reports a case in which sarcoid followed tattooing. Cipollaro (10) suggests the possibility of keloid as a complication. Sharlit (11) has reported an instance of the development of a melanoma 4 years following accidental tattooing with an indelible pencil.

In recent years increased consciousness of antisepsis and, in some states, close supervision of the operators have virtually eliminated infection as a complication of tattooing. There have, however, been a few reports of reactions due to hypersensitiveness to the colored ingredients. These have always been caused by the red material, cinnabar. Unna (12) reported the case of a man, aged 63, who had been tattooed in his youth. At 40 he developed syphilis and received treatment with mercurial inunctions which were apparently tolerated. At 60, however, he was treated for hemorrhoids by the application of mercuric bichloride wet packs. He developed a severe acute vesicular dermatitis of the anal region and a similar severe dermatitis in the red (cinnabar) portions of the old tattoo. The skin test with a mercury plaster was positive.

Madden (13) reported the case of a man whom he saw 7 years after he had been tattooed. The patient had suffered from inflammation over the entire design the day following the tattooing. After 3 weeks the inflammation in the blue areas had subsided, but the red areas remained elevated, slightly crusted, and moderately pruritic for the entire 7 years. Patch tests were positive to 2-percent ammoniated mercury, mercurous and mercuric chloride, but not to 2-percent mercuric sulfide (cinnabar).

A patient of Ballin's (14) developed swelling, itching and oozing of the red areas 2 years after the tattooing and showed positive patch tests of ammoniated mercury and mercuric bichloride, 1:1,000 solution, but not to cinnabar.

Sulzberger (15) presented a patient who developed swelling

and infiltration of the red areas several years after the tattooing. Sulzberger's case appears to be the first in which the patch tests were positive not only to the white ammoniated mercury and bichloride of mercury but also to cinnabar.

More recently Novy (16) described the second case in which the red areas of a tattoo became inflamed and the patient reacted to patch tests with cinnabar. In Novy's patient there was also systemic involvement with fever, and a disseminated macular and edematous eruption which the author attributed to the mercurial preparation.

Although these reports do not indicate the frequency of such complications, the greatly augmented size of the military services with the concomitant rise in the prevalence of tattooing may make such cases far from rare.

REPORT OF A RECENT CASE

A sailor, aged 22, was seen at the U. S. Naval Disciplinary Barracks, Hart's Island, Receiving Station, New York. He had been tattooed with a blue and a red material on both forearms 4 months previously and now complained of irritation in some areas of the tattoo sites.

Examination.—At the time of the first examination, all the red areas, in which it may be assumed cinnabar had been used, were vivid and raised above the level of the general skin surface. This is shown in the accompanying illustration. These changes were said to be of about 2 or 3 weeks' duration. A week previous to our first examination an external medicament had been applied in order to relieve the itching of the elevated lesions. Following this, the swollen areas had become scaly and crusted.

History.—The patient's history and family history did not disclose allergic diseases. He had had no dermatoses of any kind. He stated that he had not used cinnabar or any other mercurial preparation at the time when the swelling of the cinnabar-tattooed areas began.

First patch tests.—A first series of patch tests gave the following results:

- | | |
|--|----------------------|
| 1. Sulfur precipitate, 10% in yellow vaseline..... | negative |
| 2. Cinnabar, 3% in yellow vaseline..... | negative |
| 3. Mercurochrome, 2% solution..... | negative |
| 4. Calomel (powder) | 1 to 2 plus |
| 5. Mercuric bichloride, 1:1,000 in water..... | 1 to 2 plus |
| 6. Ammoniated mercury, 10% in yellow vaseline.. | positive or negative |

Subsidence.—When the patient was seen a week later, the lesions showed improvement. There remained only slight elevation and little infiltration, scaling, and crusting of the red areas of the tattoo. The itching had subsided.

Reapplication of patch tests.—On the reapplication of patch tests the reactions were significantly different from those observed the previous week, when the red parts of the tattooed areas still showed considerable elevation and infiltration. Each test was applied to a fresh, previously untested site on the back. The retest produced only a questionable or negative response to the mercury bichloride 1:1,000. This coupled with the subsidence of the clinical



Appearance of tattoo on left arm in interval between two series of patch tests, when reactions in cinnabar sites were beginning to subside.

lesion seemed to indicate a spontaneously diminishing clinical sensitivity associated with a diminished response to the patch test.

Allergenic potency proved.—In order to make certain that each of the two mercuric bichloride solutions used in the successive tests had the same allergenic potency, a patch test of each was applied to the back of a known mercury-sensitive subject who was placed at our disposal by Doctors Frances Pascher and Richard J. McDonald of the Skin and Cancer Unit, New York Post-Graduate Medical School and Hospital, Columbia University.

The results demonstrated that the two solutions of mercuric chloride were of approximately equal biologic (allergenic) potency. It therefore appears that our patient's lesser reaction to the second patch test was due to a general reduction in the level of the skin's sensitivity to mercury and that this reduction in sensitivity coincided with the abatement of the clinical reactions at the sites tattooed with red mercuric sulfide.

Conclusion.—As far as can be ascertained, ours is the first reported case of eczematous allergy in which successive patch tests revealed a loss or diminution of allergic skin sensitivity occurring rather rapidly despite (or perhaps because of) continued exposure to the allergen, and coinciding with a remission of clinical allergic disease in a skin site still under constant exposure to the causal agent.

SUMMARY

1. The role of tattooing in the transmission of infectious diseases and in the production of hypersensitivity to mercury is discussed. The latter will probably be the most frequent type of complication encountered in the greatly increased number being tattooed among service personnel. A case illustrating this complication is presented.

2. Our case and the majority of cases thus far reported do not reveal reaction to patch tests with the mercurial actually used in tattooing, red mercury sulfide or cinnabar (2 exceptions); they do reveal reaction to other more soluble and more highly dissociated mercurials.

3. Cinnabar can produce the sensitizations and can elicit allergic reactions both clinically and, occasionally, on patch tests. This is proof of the specific biologic effect of this mercurial and also indicates that this material has a certain degree of solubility in the tissue fluids.

4. The positive patch test reaction to calomel in our case is also of interest in this connection, and throws some light on the biologic local effects and solubility of this commonly employed venereal disease prophylactic.

5. Previously reported cases of exacerbations of red tattoo sites have proved that this reaction can occur suddenly after many years of quiescence and without ascertainable cause. This is evidence that sensitization can take place without any demonstrable reason even after long periods of exposure and of continued immunity to the allergen.

6. The present case again demonstrates this point; moreover, the subsidence of the clinical allergic lesions synchronously with the reduction of the skin's capacity to react to patch tests with the allergen in question constitutes strong evidence that contact-type allergic eczematous hypersensitivity may rapidly subside and perhaps even disappear as unaccountably as it appeared. It is also noteworthy that in our case the skin hypersensitivity continued to diminish despite (or perhaps because of) uninterrupted exposure to the allergen.

7. It appears that these observations may be of theoretic and immunologic interest. Their possible implications with regard to such practical problems as spontaneous desensitization and the medicolegal and compensation aspects of occupational eczemas require no further comment.

REFERENCES

1. LACASSAGNE: Les tatouages, 1881; cited by SHIE, M. D.: Study of tattooing and methods of its removal. *J.A.M.A.* 90: 94-99, January 14, 1928.
2. MAURY, F. F., and DULLES, C. W.: Tattooing as means of communicating syphilis; investigation of twenty-two cases exposed to inoculation with virus of mucous patches, in fifteen of which syphilis followed. *Am. J. M. Sc.* 75: 44-62, January 1878.
3. CHEINISSE, L.: Chancres syphilitiques multiples consécutifs au tatouage. *Ann. de dermat. et syph.* 6: 1-5, 1895.
4. DOHI, S.: Tattooing and syphilis. *Arch. f. Dermat. u. Syph.* 150: 38-40, February 1926.
5. BELOTE, G. H.: Tattoo and syphilis. *Arch. Dermat. & Syph.* 18: 200-209, August 1928.
6. GOULD, G. M., and PYLE, W. L.: *Anomalies and Curiosities of Medicine.* W. B. Saunders Co., Philadelphia, 1897. p. 751.
7. COLLINGS, D. W., and MURRAY, W.: Three cases of inoculation of tuberculosis from tattooing. *Brit. M. J.* 1: 1200, June 1, 1895.
8. BERCHERON, E.: *Histoire médicale du tatouage.* 1862.
9. MADDEN, J. F.: Reactions in tattoos. *Arch. Dermat. & Syph.* 40: 256-262, August 1939.
10. CIPOLLARO, A. C.: Keloid following removal of tattoo mark. *Arch. Dermat. & Syph.* 36: 160, July 1937.
11. SHARLIT, H.: Melanoma caused by indelible pencil. *Arch. Dermat. & Syph.* 37: 301-306, February 1938.
12. UNNA, P.: Quecksilberüberempfindlichkeit und Tätowierung. *Arch. f. Dermat. u. Syph.* 160: 153-155, August 1930.
13. MADDEN, J. F.: Chronic inflammation in tattoo mark. *Arch. Dermat. & Syph.* 38: 481, September 1938.
14. BALLIN, D. B.: Cutaneous hypersensitivity to mercury from tattooing; report of case. *Arch. Dermat. & Syph.* 27: 292-294, February 1933.
15. SULZBERGER, M. B.: Tattoo dermatitis (sensitivity to cinnabar?). *Arch. Dermat. & Syph.* 36: 1265, December 1937.
16. NOVY, F. G.: Generalized mercurial (cinnabar) reaction following tattooing. *Arch. Dermat. & Syph.* 49: 172-173, March 1944.

THE DENTAL STATUS OF MIDSHIPMEN

SIXTEENTH CLASS, U.S.N.R. MIDSHIPMEN'S SCHOOL
NEW YORK CITY

JAMES M. DUNNING
Lieutenant (DC) U.S.N.R.

Every class entering the U. S. N. R. Midshipmen's School receives a physical examination of which the dental examination by dental officers is a part. About 1,200 midshipmen must be examined in 2 or 3 days; therefore great detail in each dental examination is not possible. Mirror and explorer are used. The patient is seated in a common chair and illumination is supplied by a gooseneck desk light. The examiners concentrate on missing teeth (which include unerupted teeth) and the location of restorations for identification purposes. Important lesions of caries and other mouth diseases are likewise recorded. Midshipmen showing any lesions of caries whatever are placed on a treatment list, so that they will receive restorative treatment and further detailed examination in the dental office. This list, for the sixteenth class, included more than half the class.

In appraising the initial examinations, listings of missing teeth are reasonably accurate; recording of restored teeth is somewhat low, particularly those teeth with anterior silicate cement restorations. Charting of well advanced caries seemed satisfactory but was low for early lesions, except perhaps on the occlusal surfaces. Comparisons of any sort within the group should be fairly accurate, as all five dental officers performing the examinations had worked together for some time and were members of the regular staff.

The dental records (Form H-4) of 1,208 of the midshipmen of the sixteenth class, admitted in October 1943, were abstracted and totals were taken for carious, missing and restored teeth, designated as "decayed," "missing," and "filled." Third molars were omitted from the study in view of the impossibility of distinguishing between unerupted third molars and those lost through pathosis, but a count was kept of pathologic third molars to add to the column headed "decayed," for determination of observed dental needs. The low number of teeth indicated for extraction, only six in the entire group, was combined with the figure for missing teeth. This low figure must not be taken as an

accurate appraisal of all needed extractions, because in most instances deep caries lesions were charted as such and the decision as to whether to treat or extract was left to the dental officer performing treatment. The ages of the midshipmen were tabulated, and the class was found to average 21.6 years in age, with 750 of its members actually either 21 or 22.

The class as thus examined showed an average dental status of 9.78 DMF (decayed, missing, and filled) teeth per person, of which .58 were decayed (excluding third molars), .68 missing, and 8.52 filled. The figure .68 missing teeth is probably accurate, as mentioned previously, but the other items, including the DMF total, are probably somewhat lower than would be the case with more detailed examinations. A comparison of the midshipmen with outside groups shows them to be about average in life experience of caries (DMF), but unusually low in tooth mortality (missing teeth).

COMPARISON WITH OUTSIDE GROUPS

Klein's study (1) of 642 young men of draft age from Maryland and West Virginia gives a separation of acceptable from rejectable men according to Selective Service requirements in 1941. The acceptables had a DMF total of 9.6 and a tooth mortality of 2.6 for the age group 21-22. The rejectables had a DMF of 20.0 and a tooth mortality of 13.4. These rates include third molars, but figures for third molar morbidity and mortality for the group indicate that the tooth mortality figures would be only .1 of a tooth less and DMF teeth only .8 of a tooth lower had third molars been excluded. The midshipmen should naturally be compared with the acceptable group. With a somewhat higher DMF, the midshipmen have a strikingly lower tooth mortality. Klein's 21-22 age group with acceptables and rejectables combined, and with third molars excluded (2) shows a tooth mortality of 3.4 and a DMF total of 9.7, the mortality again being far above that of the midshipmen. As evidence that regional differences have not greatly affected this result, it should be pointed out that the midshipmen from the Middle Atlantic and Central States had a DMF total of 10.34 and a tooth mortality of .78, which was not much different from the average of the class as a whole.

Other outside groups with whom the midshipmen can be compared include 1,946 Home Office employees of the Metropolitan Life Insurance Company, surveyed in 1942 (3) and Klein's composite sample of approximately 45,500 white male adults in the

United States, reported (4) in 1943. The Metropolitan group for the ages 20 to 24 shows tooth mortality of 2.6, and Klein's sample, 3.6 for the same ages. Klein's sample shows extracted third molars (including those indicated for extraction), but it is unlikely that these teeth account for more than 1.0 of the tooth mortality per case.

FACTORS INFLUENCING DENTAL STATUS

The midshipmen studied thus emerged as a group average in caries experience but well cared for, and consequently well below the average in tooth mortality. Applicants for the school are directed to have all carious cavities treated before entering service. This alone, however, would not account for the low incidence of tooth loss even if the midshipmen had fully carried the directive into effect, which they frequently have been unable to do because of lack of availability of local private dental care, and miscellaneous reasons. They appear to be a superior group, either economically or educationally, or both, with resultant better dental care than the average, from early childhood onward.

The number of carious teeth needing treatment averages .96 per person within the group. This is amazingly low as compared with Klein's figure of 5.1 for men of draft age. Three causes may operate to produce this low figure: (1) The good dental care of the group since childhood as a result of economic and educational status; (2) the ruling that caries be treated before entrance into the school; and (3) the probable low diagnosis of untreated caries as a result of the conditions under which examinations are performed. The fact that the midshipmen's DMF total is actually slightly higher than that for the acceptable draftees would indicate that carious teeth have not been overlooked in appreciable numbers, but are to be found in the column designated "filled," not the column designated "decayed." This does not mean that many lesions of caries have not been overlooked, because additional affected areas frequently are found in teeth already indicated as carious or filled, without adding to the total of DMF teeth in a given mouth.

REGIONAL COMPARISON WITHIN CLASS

Comparisons within the class of midshipmen are restricted almost entirely to regional ones, inasmuch as the members of the class are strikingly uniform in age, educational background, and general health. Data regarding dental status were therefore tabulated by states. Because many states were represented by small

samples, state totals were combined to give regional figures, as shown in the accompanying table. The result is a striking regional differentiation in DMF totals and a less striking but generally similar differentiation in tooth mortality. The highest caries levels were found in the New England States and the lowest in the Southwest. The Southwestern midshipmen have only 59 percent as much caries as the New England group. Other areas range fairly uniformly between the two extremes, with higher levels in the northern latitudes throughout. This follows the regional caries distribution noted by Ferguson (5) at the Naval Training Station, Norfolk, Va., and by East (6).

Dental status (excluding third molars) in 1,208 cases

Geographic area and number of cases	Teeth per person				Third molar pathosis
	Decayed	Missing	Filled	DMF	
New England States, 76 (Me. 4, N.H. 5, Vt. 0, Mass. 47, R.I. 5, Conn. 15)	.47	.84	10.89	12.21	.21
Northern Great Lakes States, 147 (Mich. 66, Wis. 36, Minn. 45)	.43	.95	10.51	11.93	.35
Middle Atlantic States, 210 (N. Y. 111, Pa. 55, N. J. 32, Del. 1, Md. & D. C. 11)	.56	.85	9.83	11.25	.34
Northern Pacific States, 34 (Wash. 15, Ore. 19)	.71	.59	9.79	11.09	.23
Central States, 217 (Ohio 48, W. Va. 7, Ind. 27, Ill. 124, Ky. 11)	.49	.72	8.25	9.44	.45
Foreign and U. S. Possessions, 24 (T. H. 2, Eleven foreign countries 22)	1.17	.16	8.04	9.37	.25
South Central States, 91 (Tenn. 12, Ala. 19, Miss. 22, Ark. 16, La. 22)	.76	.44	7.45	8.65	.45
Midwestern States, 151 (Ia. 36, Mo. 46, N.D. 16, S. D. 8, Neb. 16, Kan. 29)	.67	.64	7.24	8.55	.32
Southern Pacific Area, 95 (Cal. 95)	.47	.36	7.39	8.22	.47
Rocky Mountain States, 39 (Mont. 8, Wyo. 2, Colo. 10, Utah 8, Ida. 9, Nev. 2)	.72	.38	7.03	8.12	.41
South Atlantic States, 59 (Va. 11, N. C. 11, S. C. 5, Ga. 21, Fla. 11)	.58	.71	6.74	8.02	.42
Southwestern States, 65 (Tex. 43, Okla. 15, N. Mex. 2, Aris. 5)	.78	.51	5.91	7.21	.41
Class as a whole, 1,208.....	.58	.68	8.52	9.78	.36

STATISTICAL SIGNIFICANCE

In view of the relatively small size of some regional samples, the question might be raised as to whether the differences are statistically significant. For this reason a significance test has been applied to a few of the DMF figures, by which a difference in proportion is considered significant if it is more than twice its standard error. The proportion here is the ratio of the DMF teeth in a given geographic group to the total possible number

of teeth (excluding third molars) in the sample. In the formula to be cited n refers to the total number of teeth, not to the number of cases in the sample. The ratio q is compared with a similar ratio q_1 and the standard error of the difference (σ_d) is obtained by the formula:

$$\sigma_d = \sqrt{(\sigma_q)^2 + (\sigma_{q_1})^2}$$

$$\text{when } \sigma_q \text{ or } \sigma_{q_1} = \sqrt{\frac{q(1-q)}{n}} \quad \text{and } n = 28 \times \text{the number of people}$$

Such a small difference between the Rocky Mountain States (8.12) and the Southern Atlantic States (8.02) is not significant by this test, but the difference between the New England States (12.21) and the Middle Atlantic States (11.25) is significant, as are also all larger differences.

The tooth mortality has been held so low throughout by dental treatment that none of the differences here would be significant except perhaps the largest ones, such as between the Northern Great Lakes States (.95) and the Foreign and U. S. Possessions figure (.12). These tooth mortality figures do not vary entirely in concurrence with the DMF figures and involve two factors (regional caries incidence and dental treatment) instead of only one factor. It is, therefore, advisable that these figures should not be taken too seriously either as proving or disproving the regional DMF differentiation.

SUMMARY

1. Dental records of the sixteenth class (1,208 midshipmen) at the U. S. N. R. Midshipmen's School, Columbia University, New York, show this group to be average in life caries experience but low in tooth mortality as compared with other groups in this country.

2. The low tooth mortality should probably be ascribed to good dental care within the group.

3. Regional differences in the incidence of caries are pronounced within the group, a high incidence of caries being found generally in northern latitudes, and low incidence in southern latitudes, particularly the Southwest.

REFERENCES

1. KLEIN, H.: Dental status and dental needs of young adult males, rejectable or acceptable for military service, according to Selective Service dental requirements. *Pub. Health Rep.* 56: 1369-1387, July 4, 1941.
2. KLEIN, H.: Personal communication to author.
3. DUNNING, J. M.: Data pending publication.
4. KLEIN, H.: Tooth mortality and socio-economic status—life tables for teeth. *J. Am. Dent. A.* 30: 80-85, January 1, 1943.
5. FERGUSON, R. A.: Some observations on diet and dental disease. *J. Am. Dent. A.* 22: 392-401, March 1935.
6. EAST, B. R.: Some epidemiological aspects of tooth decay. *Am. J. Pub. Health* 32: 1242-1250, November 1942.



PUNCTURE WOUND OF HEART

A 20-year-old white sailor was stabbed with a knife in the left chest, injuring the heart. He was taken to a nearby Army hospital where emergency care and treatment for shock were given, but the patient's condition progressively grew worse. He was transferred to this hospital about 3 hours later still in shock, apprehensive, and pale. The veins of the neck were distended, cardiac dullness was enlarged and the heart sounds were distant.

Soon after arrival at this second hospital the patient was operated upon to relieve the apparent cardiac tamponade. A curved incision following the course of the fifth rib was made. The costal cartilages of the fourth and fifth ribs were divided at their sternal attachments and free access to the mediastinum was obtained. The pericardium was opened and a large amount of free blood and clots evacuated. The response in the man's blood pressure, pulse, and general condition was instantaneous, and the distention of the large veins of the head and neck subsided rapidly.

The laceration of the heart, a rent about one centimeter long on the anterior aspect of the left ventricle which had severed a good sized branch of the coronary artery, was visualized. Bleeding had ceased, making suturing of the laceration in the myocardium unnecessary. The pericardium was closed loosely with interrupted silk sutures.

The patient's convalescence was uneventful, his blood pressure remaining 120/80. The wound healed per primum, and 4 weeks after the injury the patient was completely ambulatory and asymptomatic. An electrocardiograph taken at that time showed minimal changes from a normal tracing.—STARZ, W. E., Lieutenant (MC) U.S.N.R.

PRELIMINARY BITE-WING ROENTGENOGRAPHIC EXAMINATION OF NAVAL AVIATION CADETS^{1,2}

DON PARLE WHITE
Lieutenant (DC) U.S.N.R.

A study was undertaken to determine the possibility and degree of diagnostic error without the use of the bite-wing roentgenograms, among aviation cadets considered dentally rehabilitated, and to determine the probable effects of error on the performance of the cadet while in Naval Air Primary Training Command and Naval Air Intermediate Training Command.

For this preliminary survey 256 cadets were chosen. These cadets were originally examined by at least three dental officers. The original Form H-4 was filled; then the dental officer assigned in each case made his examination before treatment was begun and on its completion. When the cadet was considered dentally rehabilitated, the senior subordinate dental officer of the clinic made an examination to verify this condition.

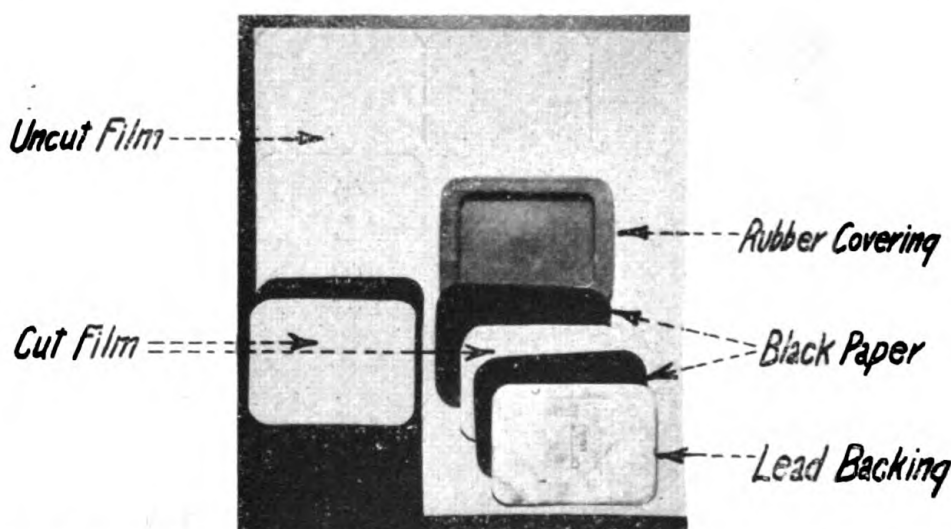
These examinations were made in the dental operating room with ample north light improved by the operating light. New mirrors and explorer points were used, and compressed air was available, but roentgenograms were not made at this time.

The term "rehabilitated" is used to mean that (1) all third molars which are not self-cleansing and all nonfunctioning teeth have been removed; (2) all carious areas have been restored; (3) all anterior and necessary posterior teeth lost by accident while on duty in the Navy have been replaced; and (4) a dental prophylaxis has been accomplished.

Roentgenographic examinations were then made in these 256 cases. Only one film was used for each side of the mouth. As there was a shortage of dental film, it was necessary to pack film at this station for use in operations that did not require clearly defined detail. Out-dated dental occlusal films and large medical films salvaged from nearby Naval activities were cut and packed in the standard dental size packets. This saving of film permitted

¹ Credit is given the dental officers and men of the U. S. Navy Pre-Flight School, St. Mary's College, Calif., for their aid in preparing the data for this article. Particular appreciation is due Commander R. W. Wheelock (DC) U. S. N.

² Read before the University of California Alumnae Association meeting January 1944 and the Berkeley, California District Dental Society April 1944.



1. Locally packed dental film made from large sheets of salvaged film. Satisfactory only for gross anatomic study.

this study without exceeding the usual allowance of dental film. Used rubber coverings and lead backings of the Bolin type were sterilized and the cut film was packed in these between black paper (fig. 1).

As the resulting film is very fast, the tube voltage should be dropped to 30,000 volts; the line voltage should be 90; and the milliamperage 14. The exposure time then ranges from $\frac{1}{2}$ to $1\frac{1}{2}$ seconds. A dental assistant can pack these films at a rate of 25 per hour. As their detail is not satisfactory for precise study of disease, they can be used only for gross anatomic study. By this addition to the film stores, sufficient grade-1 dental films were made available for this bite-wing study.

EXPOSURE, PROCESSING, DIAGNOSIS

Films were exposed at a rate of 1 per minute and thus roentgenologic examinations of eight patients were made in 16 minutes. The remainder of this half hour was utilized to process these films. This is within the safe maximum load for the x-ray unit used, a 14-minute period being allowed between groups of patients for cooling of the tube. This cooling period is imperative if the machine is to be operated on a long schedule of exposures.

For this bite-wing study, radiatized dental film was used; the exposure time ranged from $4\frac{3}{4}$ to $5\frac{3}{4}$ seconds, depending on the size and build of the patient. The standard developing technic of 5 minutes at 65° F. was used. When the film is exposed, it must be parallel to the long axis of the teeth, and the ray must enter

perpendicularly to the film. This exacting technic is necessary to gain the high degree of accuracy and detail required to determine correctly the extent of caries, which cannot be diagnosed by the three examinations made without roentgenograms by dental officers.

A dental film can be properly diagnosed only in a darkroom with a good view-box. This view-box should have an opening that is only as large as the x-ray mount, so that there is no additional light from the sides of the mount to blind and distract the reader. A cool fluorescent white globe, shining through a white flash type of glass affords the best possible detail.

A dental roentgenogram must be absolutely correct in order to attain a true and dependable image. This can be determined by noting the following points: (1) All contact points must be open (no overlapping); (2) buccal and lingual cusps must be equal in height both on the lower teeth and on the upper teeth; (3) there must be a clear definition of whites and blacks in the film.

Clinical experience with men of this age (average 20 years) indicates that caries noted in the individual tooth is approximately 25 percent more advanced than the film shows even when an exacting roentgenographic technic is employed. This is because the film does not make the fine distinction between caries and sound dentine which an experienced operator can make when actually excavating the cavity.

CLASSIFICATION OF CARIES FOR COUNTING

Enamel nicks were not charted. In order to unify the diagnoses of these films, the carious areas noted were arbitrarily divided into the following types:

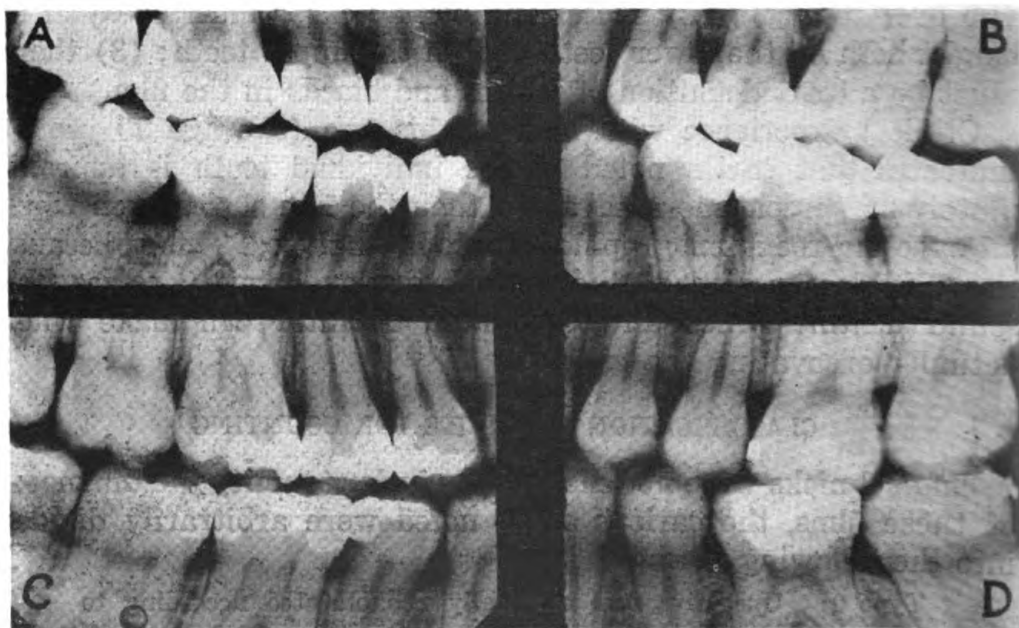
- Type 0: Operative and surgically rehabilitated according to the standards previously mentioned.
- Type I: Incipient enamel caries extending to the dento-enamel junction, or barely through the junction.
- Type II: Caries of a degree between types I and III.
- Type III: Caries extending half the distance from the dento-enamel junction to the pulp.
- Type IV: Caries with possible involvement of the pulp.

RESULTS AMONG 256 CADETS

Carious areas gave a total count of 1,414 or 5.5 per cadet; 1.8 per cadet were of type III or type IV classification and required immediate dental care; 65 percent of the 256 cadets had these III and IV type areas; 25 percent of the 256 cadets had caries of the I and II types. This made 3.6 areas per cadet with a total of 946 areas of types I and II caries.

There were five caries-free patients or 1.9 percent of 256; 28 operative and surgically rehabilitated patients or 10 percent of 256. There were 151 impacted teeth and 12, or 4 percent of 256, patients had pulpless teeth.

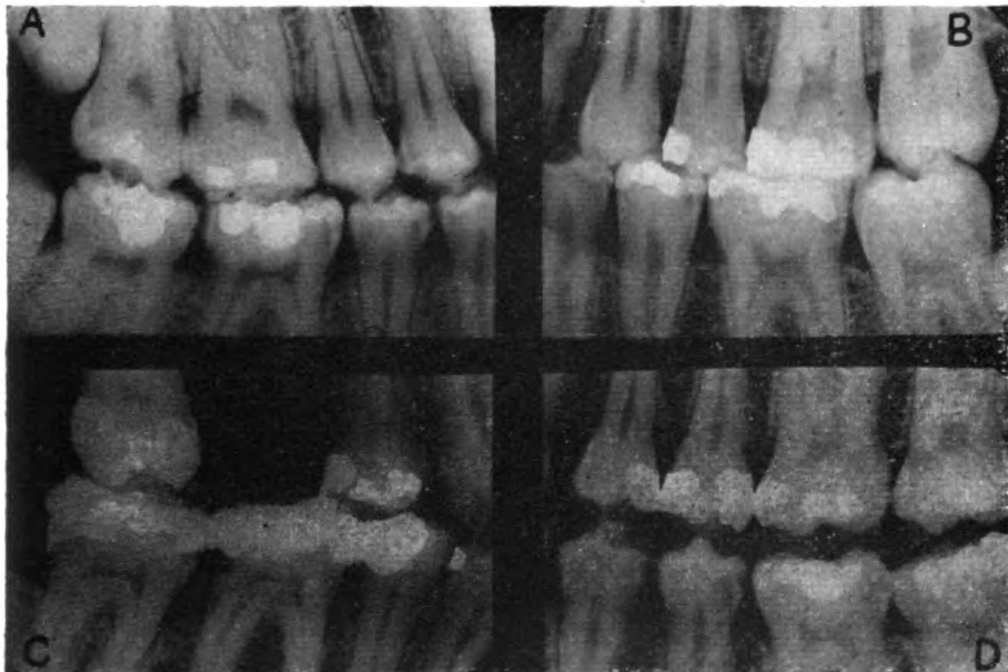
It would not be unreasonable to estimate that 39 percent (table 1) of these cadets might experience dental pain during flying or ground school in the year of training that follows the pre-flight school program. Certainly this probability of dental pain cannot be ruled out by rehabilitation of all patients, but we should safely say that nearly all should be eliminated if the 65 percent of the cadets with large types III and IV carious areas were treated. With this type of care, only routine emergency treatment or treatment necessary to maintain a mouth in healthy condition after it



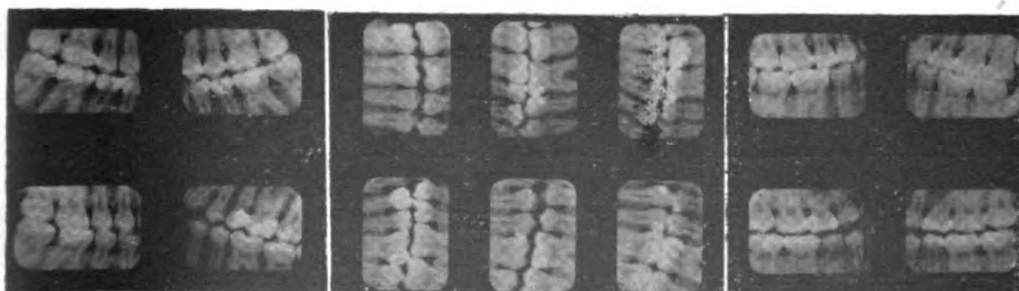
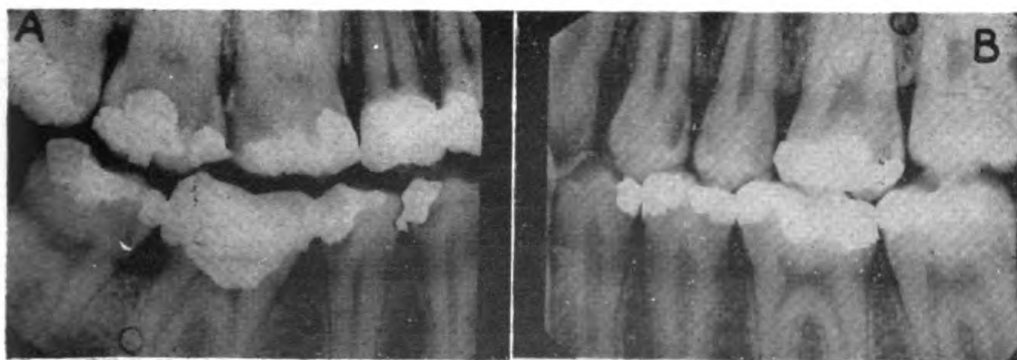
2. A and B. Caries classification type 0. C. Type I caries under restoration. D. Caries.

has been properly restored should be necessary in the year that follows pre-flight school.

One of the problems of the pre-flight school, then, is to make these cadets dentally fit for the uninterrupted study of Naval flying. Time taken out for necessary dental treatment at pre-flight schools is important, to be sure, but it can be more satisfactorily arranged there than at any other point in the program, particularly if the cadet is otherwise kept from flight training for routine dental care which might have been discovered and treated at the earlier stage of his training.



3. **A.** Type II. Caries under restoration.
B. Type II. Caries. No previous treatment.
C. Type III. Caries under restoration.
D. Type III. Caries. No previous treatment.



4. Examples of caries classification type IV (**A**—caries under restoration; **B**—caries; no previous treatment) and practical method of mounting seven sets of bite-wing roentgenograms on one full-mouth mount.

Deep, hidden caries would call for immediate treatment in the program of examination advocated, because such caries might otherwise lead to a severe toothache after the flyer had been considered dentally rehabilitated under the method of examination in which bite-wing roentgenograms are not used.

TABLE 1.—*Analysis of first 256 cadets*

	Type O	Small ← Caries → Large			
		Type I	Type II	Type III	Type IV
Caries	Rehabilitated Cases	268	667	226	33
Caries Under Restorations		0	11	84	125
Total Caries Areas.....		268	678	310	158
Number of Cadets	33	10 or 3%	57 or 22%	67 or 26%	101 or 39%
	or 10%	25%		65%	

TABLE 2.—*Analysis of 544 cadets and grand total of 800 cadets*

	Type O	Small ← Caries → Large			
		Type I	Type II	Type III	Type IV
Caries	Rehabilitated Cases	423	1032	310	40
Caries Under Restorations		2	26	155	180
Total Caries Areas.....		425	1058	465	220
Number of Cadets	71	27 or 5%	152 or 28%	148 or 27%	108 or 20%
	or 13%	33%		47%	
Grand Total of 800 Cadets	104	32 or 4%	200 or 25%	192 or 24%	256 or 32%
	or 13%	29%		56%	

SUMMARY

1. Considerable error in diagnosis occurs when roentgenograms are not taken.
2. This error is particularly hazardous to the aviator.
3. Dental film can be packed (when emergency requires) by a

hospital corpsman at the rate of 25 per hour with proper equipment.

4. The maximum safe load for the particular dental x-ray unit used should be ascertained. For the unit used at this station the safe load was approximately 35 exposures per hour, if each of these exposures is approximately 5 seconds.

5. Exposing and processing of dental film and viewing and diagnosing roentgenograms must be meticulously done to obtain proper results.

SUPPLEMENTAL SURVEY

A supplemental survey was made among 544 cadets who were treated subsequent to the preliminary bite-wing roentgenographic examination. A high degree of correlation of results was shown when this larger number of cadets was considered. It is felt that this correlation tends to verify the conclusions drawn (table 2).

The supplemental survey of 544 cadets disclosed the following: (1) Caries-free, 3.5 percent; (2) operative and surgical rehabilitations, 13 percent; (3) total impacted teeth, 309; (4) total pulpless teeth, 39; (5) total carious areas, 2,168 or 3.8 per cadet; (6) 47 percent of cadets each have 1.1 areas requiring immediate care; (7) 33 percent of cadets each have 2.1 areas of type I or II caries.

AVERAGE GRAND TOTAL OF 800 CADETS STUDIED

The following figures represent the average grand totals among 800 cadets studied: (1) Caries-free, 25 out of 800 or 3 percent; (2) operative and surgical rehabilitations, 104 out of 800 or 13 percent; (3) total number of impacted teeth, 450; (4) total number of pulpless teeth, 47; (5) total number of carious areas, 3,582 or 4.4 per patient; (6) 56 percent of cadets have 1.4 areas each that need immediate attention; (7) 29 percent of cadets have 3 areas each of type I or II caries (table 2).

CONCLUSIONS

1. Bite-wing roentgenograms make it possible to discover pulpless teeth in 5 percent of the patients. Many of these teeth require extraction to rehabilitate the patient.

2. Bite-wing roentgenograms locate 4.4 carious areas per patient; many of these areas are large enough to require immediate attention.

3. In 56 percent of the patients studied, bite-wing roentgeno-

grams located 1.4 carious areas requiring immediate attention (types 3 or 4). These areas had not been detected when the routine examining technic was used (three mouth mirror and explorer point examinations).

4. Bite-wing examinations are necessary to dental rehabilitation. Only 13 percent of the patients can be rehabilitated with their aid.

5. These conclusions were derived from the average count made by fourteen dental officers.

6. The aviator must be considered a special type of person. A simple toothache may so distract him in his duties in flight as to influence adversely an entire mission.

7. The major portion of the dental program for the Naval air cadet is undertaken at the pre-flight school so that the cadet can continue uninterrupted flight training in the primary and intermediate training commands.



TOXICITY OF PENICILLIN

A study of over 300 lots of penicillin sodium produced by fourteen manufacturers showed all to pass the mouse safety test.

There is a wide variation in the acute toxicity of different manufacturers' products. Some products are lethal for mice in concentrations of 3,500 to 5,000 units while one manufacturer is producing penicillin sodium lethal only at doses of 25,000 to 32,000 units.

A comparison of commercial samples of penicillin calcium and penicillin sodium made from a single master lot showed the calcium salt to be by far the more toxic preparation. The greater toxicity of the calcium over the sodium salt of penicillin should not discourage its clinical use in man. The toxicity of the penicillin calcium is primarily due to the cation.

The toxicity of high potency samples of penicillin sodium and high or low potency samples of penicillin magnesium is primarily due to the cation used in producing these preparations. Similarly, the cation contributes substantially to the toxicity of penicillin ammonium.—WELSH, H.; PRICE, C. W.; NEILSEN, J. K.; and HUNTER, A. C.: Acute toxicity of commercial penicillin. *J. Lab. & Clin. Med.* 29: 809-814, August 1944.

PSYCHOSES IN NAVAL INDUCTEES WITH LESS THAN FIFTEEN DAYS' ACTIVE DUTY

**NEED FOR EARLY ELIMINATION
OF POTENTIALLY PSYCHOTIC**

OTTO ALLEN WILL, JR.
Lieutenant (MC) U.S.N.

Only a comparatively small number of psychiatric casualties are being treated near battle areas and returned to full duty status. Those who have treated such casualties in the North African theater have been able to send fairly large numbers of neurotic individuals to limited duty, but have recommended only a very small number for further participation in actual combat activities. Psychotic cases are all returned home for hospitalization and eventual discharge.

As has been pointed out many times the man who must be hospitalized because of a mental illness is not only one of the most difficult of medical problems, but is in addition a military and social responsibility of no little degree. The man aboard ship or on land who succumbs to a nervous ailment becomes at once an element destructive of group morale, as in him his companions see an intensified reflection of their own fears and insecurity. The psychiatric casualty, therefore, must be quickly evacuated, and in most instances, must travel far into the interior before adequate facilities for his care can be provided.

Complete rehabilitation for military service is as yet the exception rather than the rule, and the majority of neuropsychiatric patients receive medical discharges after periods of hospital care usually exceeding in duration those given to any other type of patient because of the tendency toward chronicity and recurrence of mental illnesses. During the years since 1918 there has come an increasing realization of the financial cost, to say nothing of the personal tragedy of neuropsychiatric casualties. We have learned that a mental illness is sixteen times more likely to result in permanent disability than are other diseases (1) and that each such case from World War I has cost the country about \$30,000 to the present time. In June 1940 there were 33,016 neuropsychiatric patients in 27 Veterans' hospitals in the United States, forming over 50 percent of all beneficiaries under treatment in all of the 79 Veterans' hospitals then operating (2).

Such facts assume greater significance when we realize that a man suffering from a neuropsychiatric disorder tends to break down comparatively early in his military career, and hence has in many cases contributed relatively little as a member of his service group. An analysis of patients discharged from an Army camp for neuropsychiatric reasons showed that 50 percent were disabled in the first month of service, 75 percent in the first 2 months, and 97 percent within 6 months (3). In such cases the expense of the man's training and maintenance is completely wasted, while his disability interferes with the training of others, is destructive of morale to a considerable degree, and because of its slow recovery rate, prolongs the use of hospital beds that are greatly needed for other casualties.

Finally it is well known that the individual who is mentally ill tends to remain a liability after his discharge from the service. As yet we have no satisfactory methods of treatment whereby the psychiatric casualty may be returned to arduous duty without the greatest likelihood that his illness will recur; he is therefore generally looked upon as an irreparable liability, an attitude unfortunate for physician, patient, and all others concerned.

The answer to this problem would seem to be the elimination of the potentially misfit from the induction line. Although this is easily said and has been emphasized by numerous writers, the importance of the problem is not so well recognized in lay and civilian groups as in medical or military centers. As the war progresses greater numbers of men are called to service, and at the same time men are reclassified and many previously rejected may be called to duty as induction standards are lowered. It then becomes necessary to learn more efficient methods of eliminating the potential psychiatric casualty, and to make clear to the public the need for such elimination.

There are few objective tests that may be applied to determine the stability of a personality, and selection must be made largely on the basis of the examiner's rather subjective impression of the candidate for military service, usually the result of an interview lasting only a very few minutes. The examiner's difficulties are further complicated by the fact that the inductee may very well wish to conceal evidence of past social maladjustments or of mental illness, because of feelings of shame. Such selection could be facilitated greatly if social service data were available on the inducted men (7). However even with adequate social studies there would still be considerable divergence of opinion concerning which factors or combination of factors should be considered of sufficient significance to justify rejection from military service.

In reviewing the histories of men who have suffered mental breakdowns while on duty one is impressed by the frequency of various evidences of past inability to adjust socially and of emotional instability and immaturity. Such men could be rejected by examining boards if more adequate histories were available and more careful studies made. An objection commonly raised is that we do not have an adequate control group as we do not know how many men making a satisfactory military adjustment have in their backgrounds many of the same undesirable traits. An interesting study considering this point has been made recently of Army patients (4).

The Navy in the past has followed the policy of surveying men disabled at any time by nervous ailments, and that policy is still pursued, with the exception of the efforts that are being made to rehabilitate for military duty men who have suffered temporary and minor nervous disabilities as the result of prolonged military operations. All cases of psychoses are surveyed from the service, such casualties eventually being sent to the U. S. Public Health Service Hospital at Fort Worth, Texas, or to St. Elizabeths Hospital, Washington, D. C.

During the 10 months from 1 January to 1 November 1943, 1,022 service cases were admitted to St. Elizabeths Hospital, the majority having been diagnosed as psychotic. All of these men had been treated previously at one or more Navy hospitals. These 1,022 patients were analyzed to determine the length of active duty each man had before his first admission to the sick list with the illness that caused his eventual transfer to St. Elizabeths. The results are shown in table 1.

TABLE 1.—1,022 patients (Navy, Marine, Coast Guard, few Army) admitted to St. Elizabeths Hospital 1 January, 1943 to 1 November, 1943

Number of cases	Percent	Time of active service before first admission to sick list because of present disability
150	14.6	Less than 15 days
223	21.8	More than 15 days, but less than 3 months
173	16.9	From 3 to 6 months
215	21.1	" 6 " 12 "
138	13.5	" 1 " 2 years
123	12.1	Over 2 years
1,022	100.0	

Of this group 53.3 percent broke down during the first 6 months of military service, while 74.4 percent were hospitalized within the first year.

It was decided to study in some detail the group having less than 15 days of active duty, as it was believed that in this brief period of service, the most important factors operative in causing the individual's illness are the essential weaknesses of his own personality structure, revealed by exposure to the aggressive life of a training camp. Within the 15-day period any unusual traumatic factors (such as great fatigue) can scarcely be operative, except the influence of homesickness and the difficulties incident to a necessarily rapid adjustment to military life. It would seem that men breaking down within such a short period of time must have had well established personality defects, which, had they been known, would have led to their rejection by the induction board.

In order that the group might be as nearly homogeneous as possible, only noncommissioned white males were chosen. This left for study 100 white noncommissioned men having had less than 16 days of active duty prior to their admission to the sick list and admitted to St. Elizabeths Hospital over a 10-month period. As a control group, 100 hospital corpsmen were studied. These men had been in the Navy varying lengths of time (average $12\frac{1}{2}$ months), but all had successfully completed their training, and made a satisfactory service adjustment. Study of the patients was made by means of the usual rather extensive psychiatric history, supplemented by data obtained by social workers. A condensation of this form was used in studying the control group; however no social service investigation was made of the controls. The purpose of the questioning was carefully explained to the control group; they were not individually interviewed, and their names were not attached to the questions.

An attempt was made to include only those items which might readily be determined by social workers or by a physician in a hasty interview. The following outline includes certain elements which are of interest in comparing the two groups under discussion, but would not necessarily be included in a questionnaire prepared for inductees. The points considered are listed below under separate headings.

Hospitalization.—Of the 100 men under study, 5 displayed such abnormal actions that they were placed under observation while on their way to training camp, 11 were taken from the recruit line at the camp, and 84 were detected during the following few days.

These men were admitted to local hospitals at the various training centers, and then sent to other Naval facilities, eventually arriving at St. Elizabeths Hospital for final disposition. (The serviceman is eligible for care at this hospital as long as he may

need it, even after his discharge from the service, although he may be transferred to a Veterans' hospital should he so desire). The average total length of time spent in Naval hospitals before being admitted here was 28 days. At this writing 81 of the 100 patients had been discharged, their average length of stay in this hospital being 95 days. This group therefore had a total hospitalization period of about 4 months (average 123 days) before being returned to civil life. The greater number of servicemen now passing through this hospital conform rather closely to these figures. The condition on discharge of these 81 men is shown in table 2.

TABLE 2.—*Condition on discharge from St. Elizabeths Hospital*

	No. of cases	Percent
Recovered.....	18	22
Social recovery.....	27	33
Improved.....	32	40
Unimproved.....	4	5
	81	100

Of this total 76 or 93 percent were discharged within 4 months, the remaining 5 being discharged after periods of from 5 to 10 months. Treatment consisted of that which is usually available in large institutions—hydrotherapy, occupational therapy, superficial psychotherapy, and electric shock (used in 9 cases of this series). Extensive psychotherapy is not possible because of the heavy case load and the relatively small number of physicians available.

Of the 19 cases not discharged at this writing 11 had been hospitalized at St. Elizabeths less than 6 months, while 8 had been there from 6 to 11 months and were showing only very slow improvement. It is anticipated that within the next 6 months the greater number of these 19 patients will be discharged.

The economic aspect of this problem cannot be ignored. There is first the cost of hospital care for each of the 28 days prior to arrival here; to this must be added the pay received by each patient. Yet this is insignificant when we consider the fact that each of these men by virtue of even a few days' service is eligible for lifetime care in a Veterans' hospital and may well become a claimant on the state under future bonus plans. In addition such men are completely nonproductive during their hospitalization; whereas if they had remained in civilian life they might have been able to avoid an actual breakdown and have been of value to their respective communities.

Type of illness.—As these men moved from one hospital to another their appearance from a psychiatric point of view often

underwent considerable change. In the majority of cases the noteworthy characteristics of the illnesses were the sudden, violent onset of symptoms, the rather rapid subsidence without specific treatment soon after hospitalization, and the apparent significance of situational factors. These have been noted previously by Duval and Hoffman (8). The prognosis, even without specific therapy, is good, hospitalization itself playing an important role, as many situational elements are thus eliminated and the patient's feelings of insecurity somewhat relieved.

Table 3 shows the final diagnoses made in the 100 cases under consideration. These diagnoses were applied after approximately 2 months of hospital observation.

TABLE 3.—*Final diagnoses of cases*

Diagnosis	Number of cases
I. Manic depressive psychosis:	
A. Manic phase	5
B. Depressed phase	3
Total....	8
II. Dementia praecox (schizophrenia):	
A. Catatonic type	47
B. Paranoid type	9
C. Hebephrenic type	4
D. Mixed type	4
E. Undetermined type	15
Total....	79
III. Undiagnosed psychosis	6
IV. Involutional melancholia	1
V. Psychosis, alcoholic	2
VI. Psychosis with mental deficiency	3
VII. Psychoneurosis (hysteria)	1
	13

The large majority of schizophrenic reaction types is the most striking feature noted. It will be interesting to compare this percentage at some later date with psychotic casualties evacuated from combat areas.

Of the 100 patients, 6 had made serious suicidal attempts, an illustration of the rapid breakdown of the defenses of an already unstable individual when there was a sudden increase in his feelings of insecurity by virtue of his rapid transfer to a military environment. Faced by an apparently intolerable situation the man seemed to rush to the very definite protection afforded by his illness. In these men the psychosis seemed to be a more functional and obviously protective device than is usually seen in peacetime in civilian life.

In none of these men was there any question of malingering, but each buried himself in a psychotic maelstrom, being quite in-

capable of effecting an adjustment to the actualities of the situation. Improvement in most instances followed rather quickly upon removal from the traumatic environment, and the assurance that further military duty would not be required.

Age.—An outstanding feature of both groups was their youth. The ages of the patients ranged from 17 to 49 years. Of this number, 54 were under 20 years, while 90 were less than 30 years of age, the remaining 10 ranging from 31 to 49 years. With one exception (the man aged 49) all were subject to draft, and the great majority were inducted.

Twenty-two of the patients had shown a marked fear or resentment of induction. Forty-four definitely stated that they had no desire to enter the service. Twenty-nine had been eager to enter for patriotic reasons. In one instance the man had been retarded and hallucinated, but was urged to go into the service by his parents who believed that camp life might effect a cure. The remaining four joined "to get away from it all."

The control group ranged from 18 to 36 years, with 26 being less than 20 years, while 85 were less than 30 years. Of the controls, 40 entered the service for patriotic reasons, 55 were inducted, 3 wished to make the Navy a career, and 2 joined to escape an unhappy marital life. All were subject to induction.

Family relationship.—Some difference was noted in the two groups when an attempt was made to evaluate the degree of happiness found in the home life. In the control group 90 individuals considered their home life happy and looked back with pleasure upon their formative years. Ten stated that the home had been disturbed by conflict between parents. In 6 instances the father had died when the child was less than 10 years of age, and in 5 the mother had died during this period, but in only one instance had both parents died before the child had reached maturity. None of these children were cared for in institutions or foster homes, but were supported by the surviving parent or by relatives. Divorce of the parents was noted in only two instances. Sixteen of these men said that they were very closely attached to the mother, while three were devoted to the father.

In the patient group the family life was disrupted by divorce of the parents in 9 instances, this occurring when the patient was under 10 years of age in 6 instances, the remaining 3 taking place when the patient was between the ages of 10 and 20 years. In 21 cases the family was broken by the death of the father, and in 9 by the mother's death, all of these deaths occurring before the patient was 15 years of age. Two of the children were cared for in orphan homes, and 9 were cared for by relatives. Only 49 of

the homes were listed as happy, while 11 were marred by parental discord, 11 by alcoholism of the father, 1 by an alcoholic mother, and 3 by the criminality of one or both parents. In 3 cases the parents were listed as being cruel to their children. Twenty-eight of the patients manifested an extremely close attachment to the mother, and two showed a similar attachment to the father.

Although these findings are not conclusive, it is emphasized again that a stable home, which offers the child security and aids him in developing self-confidence, plays an important role in forming an intact personality pattern. For this reason information concerning the home environment of the prospective servicemen should be available to the examining physicians.

Mental illness in the family.—In the particular groups under consideration physical illness in the family as a factor in disrupting the home seemed to be of minor importance. Table 4 summarizes the findings regarding mental illness in the family.

TABLE 4.—*Mental illness in the family*

Relative mentally ill	Emotional instability not hospitalized		Definite mental illness not hospitalized		Mental illness requiring hospital care	
	Patients	Controls	Patients	Controls	Patients	Controls
Father.....	3	1	2 (epileptics)	0	7	1
Mother.....	8	2	2	1	4	2
Both.....	1	0	0	0	0	0
Siblings.....	5	0	11	0	8	2
Uncle.....	0	2	0	2	0	0
Aunt.....	0	1	0	2	6	0
Other.....	0	2	8	0	6	3
Total.....	17	8	23	5	31	8

Fourteen of the patients' families reported two or more members mentally ill in addition to the patient. Fifty percent of the families reported no history of mental illness. The conclusion to be drawn of course is not that a man should be eliminated from service because of a familial history of mental illness, but that when such a history is presented the case should be investigated more thoroughly to determine if other characteristics of an unstable personality are present.

Infantile traits.—The persistence of certain infantile traits into adolescence and adult life is looked upon as evidence of inadequate maturation and is suggestive of personality instability. Certain of these traits may assume greater importance in military than in civil life, as they may be the cause of unfavorable comment by others, and thus increase the individual's feelings of insecurity. Enuresis for example cannot be tolerated aboard ship because of hygienic reasons, in addition to the fact that the fault cannot be

concealed and will be subject to much public comment. Table 5 outlines a number of these traits, listing only those that were persistent into adolescence or later.

TABLE 5.—*Persistent infantile traits*

Item	Patients	Controls
Enuresis.....	24	3
Temper tantrums.....	4	2
Thumb sucking.....	20	0
Stuttering.....	6	1
Night terrors.....	4	0
Nail biting.....	15	8
Sleep walking.....	4	0
Sleep talking.....	3	0
Timidity.....	3	2
Considered "sickly" by family.....	3	0
"Nervousness".....	10	0
Headache (no history of trauma).....	2	8
Claustrophobia.....	0	1
Fear of heights.....	0	3
Fear of storms.....	1	0
Fear of dark.....	2	2
Fear of water.....	1	5
Two or more of these traits present.....	25	10
Three or more traits present.....	11	3

Of the patient group, 13 were enuretic beyond the age of 11 years, whereas in the control group none displayed this trait into the twelfth year. Fifty-seven of the patients reported some of the characteristics noted in table 5, whereas 72 of the controls had none of them.

The presence of a single trait in an individual may be of questionable significance, but a combination of several would seem of sufficient importance to justify further investigation. Again it should be emphasized that few traits (with the exception of persistent enuresis) are in themselves of sufficient importance to justify rejection, but that the presence of one or more relatively minor defects may guide the investigation so that unstable persons may be identified before they become actual casualties.

It is interesting to note that five of the controls manifested a fear of water, three a fear of heights, and one fear of crowded places—definitely undesirable traits in men who may be called upon to serve at a variety of stations during their Naval careers. These characteristics noted in the controls are of course more typical of the psychoneurotic, and their absence in the psychotic patients is not altogether surprising.

Previous mental illness.—It is contended that a man should be rejected by the military service if he has previously suffered from a mental disorder. The man who has made a satisfactory adjustment to civil life after recovery from a mental disease may break again under the strains incident to military existence.

Of the control group, 94 reported negative histories. Five mem-

bers of this group had at some time in their lives had their work or schooling disrupted for brief periods because of emotional disturbances not requiring hospital care. One man had been hospitalized for a few weeks because of mental illness.

Of the patient group, 7 had been previously hospitalized in mental institutions, and 10 had been cared for at home during periods of mental illness. Of those treated at home, 4 had suffered from recurrent episodes of the disorder. In addition 4 had been under psychiatric care at intervals before their entry into the service. It is interesting to note that 13 of these men displayed obvious evidence of mental disorder for some months prior to induction, 6 being actively hallucinated, 1 having made a suicidal attempt, and 1 being hampered by a profound obsessive-compulsive pattern. Only 69 of the patients gave negative histories.

Although a few individuals who have undergone a mental sickness may be able to perform adequately in military life, it is believed that the chances of recurrence are so great that all with such a history should be rejected.

Education.—A marked difference was noted between the two groups in regard to education, although the age differences were relatively insignificant. Twenty-two of the patients had only an eighth-grade training or less, and 38 had less than a high school education; 26 were high school graduates. Of the controls 40 were graduates from high school and 35 had some college training.

Participation in social activities.—An attempt was made to determine the individual's participation in the social activities of his community, with due regard to the limitations found in certain sparsely populated areas. Of the patients, 3 were considered to be above the average for taking part in social enterprises, while 64 were said to be average. Thirty-three were noted to be very inactive socially. Of the controls, 89 were active members of community groups.

Criminal record.—Of the patients, nine had been arrested for multiple minor offenses and one had served a term in an Army prison for being AWOL. In the control group six had been arrested for traffic violations.

Personality.—Seventy-eight of the controls considered themselves to be "extroverts," while 22 were listed as "introverts." Of the patients, 36 were noted as quiet and seclusive while 30 more were classed as "introverts" making an outwardly adequate social adjustment. One of the patients had been subject to marked mood swings for a number of years. Thirty-three of the patients were considered to be extrovert in type.

Employment record.—In the control group, 85 were listed as good or adequate in regard to income, performance of work, and ability to cooperate satisfactorily with superiors. Six were listed as fair or indifferent in these qualities, while 8 had done no regular work because of schooling and 1 had shifted from one job to another with little apparent reason for change.

Twenty-one of the patients had held no regular jobs because of school, and 13 had never worked because of emotional or intellectual defects, making them unemployable. Twenty-one had never held one job for any length of time, but had shifted from one to another, usually changing because of restlessness or minor dissatisfaction. Six of the men were noted by employers as undesirable for various reasons. Forty had good work records.

Alcohol or drugs.—There were no instances of drug addiction in this group. In the control group, 20 were listed as abstainers from alcohol, 79 as moderate or "social" drinkers, and 1 said that he regularly drank to excess. Of the patients, 85 drank moderately or very infrequently, whereas 15 were listed as heavy drinkers.

Emancipation from home.—In making this study the frequency with which severe nostalgia appeared was noteworthy. Flicker and Weiss (9) have discussed this problem. In 33 patients homesickness was a prominent feature. In 77 cases the entry into the military service was the first experience away from home.

Of the control group, 35 had never lived away from home for more than a day prior to their entering the Navy, and 65 had been away from home for periods of at least several months. Eighteen of the controls stated that they had been very homesick during the early training camp period, but had been able to adjust satisfactorily.

Combination of factors.—As noted previously it is rare that a man will be rejected because of a single unfavorable factor in his history. The determination of one or two such factors should lead to a search for others and a more careful evaluation of the individual. The cases presented here were reviewed with this in mind, the following items being considered: (1) Mental illness in family; (2) developmental abnormalities; (3) school history; (4) criminal record; (5) history of previous mental illness in patient; (6) personality of patient; and (7) employment record.

Seventy-one of the patients listed unfavorable items in two or more of the categories noted above. Twenty-three had three or more unfavorable listings, 19 four or more, 11 five or more, and 5 were noted in six instances. Six of the controls listed unfavorable items in three of the categories, while 2 were listed in two places.

COMMENT

In the course of this small study certain factors were noted which, it is believed, would be of value in gaging a man's fitness for military service. During the investigation rather complete histories were taken, but all elements are not reported here as they seemed of comparatively little significance in these groups and were of questionable value for inclusion in a social record to be used for induction centers. Such items were parentage, siblings (number and relation to patient), religion, type of community from which the man came (urban, rural), etc. Although some of this data could be obtained from the individual examined, more satisfactory results would be anticipated if it were received from objective sources, such as investigations by social workers.

The following points should, we believe, be included in any social study: (1) Character of the family relationship; (2) history of mental illness in the family; (3) persistent infantile traits; (4) previous mental illness; (5) educational history; (6) social life; (7) criminal record; (8) sex; (9) employment record; (10) use of alcohol or drugs; and (11) degree of emancipation from home. (The boy who has never learned to make his own decisions, who is still emotionally dependent on his home and parents, may make a satisfactory military adjustment, but he will suffer in so doing, and his chances of failure are greater than those of the boy who has achieved some degree of freedom from familial bonds.)

Prior to the present war careful investigations were made of each man enlisted in the Navy. Such meticulous studies may no longer be possible, but it is believed that the investment in time and money would be well justified should brief social service studies be carried out in each community on men subject to induction, the results being made available as confidential information to the psychiatric member of the examining board. The most satisfactory approach to this problem certainly lies in prevention. Once the illness has manifested itself the road to recovery is long and uncertain—costly to the service, the patient, his family, and his country.

SUMMARY

1. One hundred white male (Navy and Marine) psychotic (including one neurotic) patients at St. Elizabeths Hospital, Washington, D. C., were studied in an effort to determine factors which, had they been known earlier, might have served as grounds for rejection by the induction centers.

2. All of these one hundred men were hospitalized because of a

mental illness before they had served 15 days on active military duty.

3. A control group of 100 hospital corpsmen was studied, the average length of service of this group being 12½ months.

4. The two groups were compared in regard to age, parentage, siblings, family life, illness in the family, early development, previous mental illness, education, social activity, criminal record, personality, employment record, use of alcohol and drugs, and degree of emancipation from the home.

5. The patient group displayed a greater number of so-called "psychiatric determinants" than did the controls. The desirability of having such data available at the induction center is obvious.

6. The need for social service histories as an aid to psychiatric selection of inductees is stressed.

REFERENCES

1. EBAUGH, F. G.: Misfits in military service. *Dis. Nerv. System* 4: 293-298, October 1943.
2. COOLEY, M.: Economic aspect of psychiatric examination of registrants. *War Med.* 1: 372-382, May 1941.
3. ROSENBERG, S. J., and LAMBERT, R. H.: Analysis of certain factors in histories of 200 soldiers discharged from the Army for neuropsychiatric disabilities. *Am. J. Psychiat.* 99: 164-167, September 1942.
4. BILLINGS, E. G.; EBAUGH, F. G.; MORGAN, D. W.; O'KELLY, L. I.; SHORT, G. B.; and GOLDING, F. O.: Comparison of 100 Army psychiatric patients and 100 enlisted men. *War Med.* 4: 283-298, September 1943.
5. BULLARD, D. M.: Selective service psychiatry; schizoid and related personalities; mood disorders and psychopathic personalities. *Psychiatry* 4: 231-239, May 1941.
6. HALL, R. W.: Peculiar personalities; disorders of mood; psychopathic personality. *War Med.* 1: 383-386, May 1941.
7. EBAUGH, F. G.: Psychiatry in war. *Texas Rep. Biol. & Med.* 1: 41-51, 1943.
8. DUVAL, A. M., and HOFFMAN, J. L.: Dementia praecox in military life as compared with dementia praecox in civil life. *War Med.* 1: 854-862, November 1941.
9. FLICKER, D. J., and WEISS, P.: Nostalgia and its military implications. *War Med.* 4: 380-387, October 1943.

MEDICAL PROBLEMS IN AMPHIBIOUS WARFARE

THE LST IN EVACUATION OF CASUALTIES

TRACY D. CUTTLE

Lieutenant Commander (MC) U.S.N.R.

and

JOHN N. MARQUIS

Lieutenant Commander (MC) U.S.N.R.

The purpose of this article is threefold: (1) To acquaint the medical officers of the Navy with medical problems encountered in amphibious warfare and the participation of the LST in overcoming these difficulties; (2) to record our experiences in LSTs and to describe certain alterations and devices used which may prove helpful to medical officers serving in these ships; (3) to bring to the attention of those medical officers responsible for the planning of medical facilities in the LST certain alterations which have greatly improved its effectiveness as an evacuation ship.

MEDICAL PERSONNEL AND EQUIPMENT

The original medical department of the LST consisted of a small sickbay which was entirely inadequate for any medical service or surgery other than the care of the ship's company by two pharmacist's mates.

When these ships arrived in the combat area their potentialities as evacuation ships were quickly recognized. It became necessary to use these ships for the evacuation, care, and transport of casualties from combat zones to base hospitals. The original personnel and facilities were inadequate for this new task and the medical personnel was therefore augmented to include two medical officers and four pharmacist's mates per ship.

Disadvantages of tank deck as hospital area.—The tank deck was first used as the hospital area. Its space and accessibility for litters were satisfactory, but it had disadvantages:

1. There was no running water.
2. The lighting facilities were inadequate. Complete blacking out of the tank deck at night was difficult. It involved action detrimental to the safety of the ship while in the combat zone.
3. The tank deck could not be made clean. Mud and sand were

left on the deck by vehicles. It was the dirtiest place in the ship and could not be freed of insects.

4. Patients could not conveniently be brought aboard while unloading was still in progress.

5. If the tank deck was not empty on the return trip, its use as a hospital was even more unsuitable.

6. Surgery had to be performed in the wardroom, which involved disruption of the wardroom functions and a difficult, awkward transfer of surgical cases to and from the tank deck.

Necessity for primary care aboard LST.—Shortly after the LST was first used as a ship for the evacuation of wounded, it was conclusively shown that the medical departments of LSTs had to be prepared to give initial and primary care to freshly wounded men. Because the proper and opportune time for definitive surgery is in the 12-hour period following injury, this care on the LST had to include major surgery.

Three facts thrust this necessity of primary treatment upon the medical department of the LST: (1) Enemy action frequently produced fresh casualties among LST crews and passengers, whose entire care and treatment depended on LST medical facilities; (2) participation in initial landing operations when it could not be expected that shore medical facilities would be available; (3) shore medical facilities were frequently not prepared to do major surgery for days or weeks after the initial landing.

Surgery in starboard troop compartment feasible.—The greatest difficulty aboard the LST was due to the fact that most places where surgery could be done were not accessible to litters. Surgery could be done, however, under satisfactory conditions in the starboard troop compartments of an LST. These provide:

1. Four berthing compartments with accommodations for more than fifty.

2. A water closet and shower compartment with ample facilities for running water, and a hospital head.

3. Three troop messing compartments, one of which is just aft of the head. This compartment contains two tables usable for operating tables and two side bulkhead tables suitable for instrument tables. Its cleanliness and freedom from insects can be made comparable to a hospital operating room. Operating lights can be used without endangering "darken ship" regulations. Two operating teams can work in these compartments simultaneously without awkwardness.

4. Easy accessibility to sickbay and medical storeroom, regardless of unloading operations.

5. No disturbance to normal ship routine.

6. Easy accessibility of all compartments to litters once they are brought to this deck.

Alterations for adaptability for surgery.—With the permission of the task group commander and the full cooperation of the flotilla and group commanders, the following changes and additions to the medical department were made:

1. The starboard troop compartments were made accessible to litters by cutting a large hatch (and providing it with a water-tight cover) in the main deck over the after troop-berthing compartment. This hatch was designed to accommodate the loading of litters. A second hatch was cut in the bulkhead between the tank deck and the starboard troop compartment.

2. The four troop-berthing compartments were prepared to serve as wards and the hospital corpsmen's utility room. Two large lockers and a table were installed.

3. The messing compartment aft of the head was set up as an operating room. One messing table was removed and a field operating table was installed in its place. An adjustable operating light fixture, made by the ship's force, was installed over the table. The after messing table was set up as a sterile table. The outboard bulkhead tables were used for anesthesia and nonsterile supplies.

4. An auxiliary operating room was set up in another messing compartment, thus enabling two operating teams to work simultaneously.

5. An unused exhaust fan from the tank deck was connected with the troop compartments. This provided excellent ventilation to the entire hospital area.

6. Additional medical and surgical supplies were obtained. Sterile supplies were autoclaved at the base medical facilities on the beach.

7. Steps were taken to provide for rapid removal of key supplies in case of "Abandon Ship." (Empty 20 MM ammunition cases, painted white and properly labeled, make excellent water-tight containers for this purpose.)

8. The LST medical department personnel were organized so that when it was necessary to give initial complete care of wounded men, resuscitation and surgical teams were formed.

The installations and alterations listed made it possible for the LST to fulfill its mission not only of acting as a sea ambulance but also of providing excellent facilities for definitive, proper and timely surgical and hospital care of casualties evacuated from combat zones. Furthermore this has been accomplished without

interfering with unloading, normal ship operations, or the primary mission of the ship.

The efficiency of these facilities has been recognized by the task force commander. The improvements outlined enable LSTs to evacuate casualties over any distance or period demanded by the primary mission of the ships.

ORGANIZATION OF MEDICAL DEPARTMENT FOR AN LST FLOTILLA

The original organization of the medical department of LSTs and the present official organization call for two medical officers for each group of LSTs, a total of six for a flotilla, but there is no flotilla medical officer. The complement of pharmacist's mates is two for each ship.

When these ships operated as a flotilla, the medical problems demanded a flotilla organization, with additional medical personnel, and it became necessary to organize the medical department on a flotilla basis. This was done under the direction of the flotilla commander by the senior medical officer of the flotilla.

All ships in the flotilla were altered to conform to the specifications described. Ten complete portable surgical outfits were obtained from the force surgeon. The ships in any echelon were divided into two classes, medical ships and surgical ships.

1. Medical ships were organized for the evacuation of neuropsychiatric patients, medical patients, and slightly wounded ambulatory patients. The medical department of each of these ships comprised one medical officer and three pharmacist's mates.

2. Surgical ships were organized for the evacuation of seriously wounded and all casualties requiring surgical care. The medical department of each of these ships comprised a liaison team of (a) one medical officer and two hospital corpsmen, (b) a resuscitation team of two medical officers and five hospital corpsmen, and (c) a surgical team of three medical officers and five hospital corpsmen.

The liaison officers of the surgical ships were in charge of the medical department of these ships. The teams were familiar with the duties of the entire department, so that they could work with and for each other.

Liaison team.—The liaison team was to locate and cooperate with the beach dressing station and direct the loading of casualties aboard in coordination with the unloading activity of the ship. After the evacuation from the beach the liaison team directed and aided the resuscitation and surgical teams.

Shortly after beaching the liaison team went ashore and made contact with the beach dressing stations. Patients were tagged

by the medical officers on the beach, but their disposition was the responsibility of the liaison officer. He routed them to a medical or surgical ship, depending on the diagnosis, and labeled them A, B, C, or D, according to the severity of their injuries. "A" indicated that the patient was critically injured.

Resuscitation team.—The resuscitation team was expressly charged with the appraisal and diagnosis of injuries, the initial treatment for shock, and preoperative and postoperative care.

Surgical team.—The surgical team was to maintain the operating room, prepare supplies, administer anesthesia, and carry out proper definitive surgical procedures. Two officers with adequate surgical training were assigned to each team. The third acted as anesthetist.

Each ship in the initial echelons was completely equipped for surgery and personnel could be transferred to any ship if circumstances required her to act as a surgical ship.

Practice loading.—Practice loading of patients was carried out with the beach medical facilities before each initial landing. The beach medical facilities furnished the litter bearers and carried the patients aboard ship and up the elevator to the hatch in the main deck, where they were taken over by the resuscitation team.

Treatment in open wounds.—All patients with open wounds were given a "booster" injection of tetanus toxoid, sulfadiazine orally, plasma if in shock, morphine as needed for pain, sedation when indicated, atabrin salt tablets, etc.

Tagging patients.—A small plain baggage tag, on each bunk, was used to indicate whether the patient was (1) allowed fluids freely by mouth, (2) was to receive plasma or dextrose by vein, (3) was not to receive morphine, or (4) was in need of early surgery.

One hospital corpsman was detailed to give fluids in abundance to every patient allowed them by mouth.

Order of surgical treatment.—Surgical treatment was undertaken as soon as possible after the patient's general condition was satisfactory for operation. Operative patients were taken in order of their apparent urgency. The operative patients were returned to the wards and postoperative care was the responsibility of the resuscitation team.

Transfer of patients at base.—When the echelon returned to base the patients were transferred through the hatch in the bulkhead into the tank deck and to ambulances waiting at the ramp.

Several thousand casualties have been evacuated by LSTs. A majority of the casualties in the area have been transported and cared for in this way.

HANDLING OF PATIENTS

During this campaign 9,786 casualties were evacuated in a period of 9 months. Of these, 2,335 were stretcher patients and 7,451 were ambulatory patients. This represents 82 percent of all casualties evacuated by surface vessels from the combat zone.

The majority of these casualties were due to wounds, but a large number were neuropsychiatric patients. Illness of an organic nature was responsible for the smallest proportion of patients.

Neuropsychiatric patients.—Neuropsychiatric patients were treated in the following manner:

1. Filthy clothing was removed. Patients were given hot showers and clean clothing.

2. A hot meal was served and patients were put to bed.

3. Ample sedation was ordered and after a good night's sleep there was gratifying improvement in many patients.

Malaria.—Malaria is the most frequent organic medical condition responsible for evacuation in this zone.

Bacillary dysentery.—Bacillary dysentery is also a common disease. Treatment of these patients was largely symptomatic, as facilities for accurate diagnosis were not available and definitive treatment was not considered advisable during the short stay on board.

Natives evacuated: Yaws; filariasis; leprosy; childbirth.—On one occasion the entire native population of an island was evacuated from the combat zone. These natives had had no medical care for more than 2 years. Yaws was seen in every state of its development from the mother yaw to advanced lesions of the bones. Malaria, filariasis, and leprosy were also noted. It was necessary to deliver one native woman of a child, probably the first child born in an LST.

Classification of wounded.—The wounded who require surgery may be divided into two classes:

1. Those for whom delay means certain fatality. Without prompt early surgery this type surely dies before reaching base hospital facilities. With such surgery some will recover.

2. Those for whom delay carries with it a constant increase in the extent of the surgical procedure eventually to be done. This type is illustrated by the extensive wounds of muscle tissue in which, in this zone, gas gangrene develops so rapidly. Without surgery this type will reach the hospital facilities alive but often in poor condition and extensive surgery will be required. The longer operation is postponed, the greater is the resultant disabil-

ity with less chance of returning to active useful duty. With early operation this type arrives in better condition, loses less body substance by surgery, and is more likely eventually to be returned to duty.

Principles in surgical procedures.—To be life-saving and disability-preventive, surgical procedures should be carried out in the first 12 hours after the wound is received.

We have learned much from our New Zealand colleagues in this area who have had extensive experience in the Middle East. This is particularly true regarding:

1. The life-saving importance of early surgery.
2. The failure of plasma and the importance of massive rapid whole-blood transfusions in treating certain types of serious wounds. Massive rapid transfusions of whole blood will be possible in this area only when base facilities establish a blood bank. This has been attempted but many technical difficulties have arisen peculiar to the local conditions. It is hoped that the difficulties soon will be overcome.
3. The necessity of selecting the proper time for moving certain classes of wounded men.

Although present mortality records are improved over the last war, they can be further improved by applying the principles outlined to the handling of our wounded. Lives are being lost unnecessarily in every landing operation and will continue to be lost so long as we fail to bring early good surgical treatment to the patient. The surgeon should be brought to the patient, and not the patient to the surgeon. The medical departments of LSTs have made every effort to follow these principles and their efforts have been amply rewarded by the results obtained.

SUMMARY

1. Alterations and additions to the medical facilities of LSTs have been made in a combat zone. These changes enable LSTs to evacuate casualties over any distance or period demanded by the primary mission of the ship, and LSTs furnish a means of evacuating casualties which is considered superior to any other form of evacuation available in certain combat zones.
2. The medical personnel on LSTs has been augmented and organized into combat resuscitation and surgical teams.
3. In a period of 9 months, 9,786 casualties were evacuated.

This represents 82 percent of all casualties evacuated by surface vessels.

4. To be life-saving and disability-preventive, surgical procedure should be carried out in the first 12 hours after wounds have been incurred. The LSTs under the described circumstances have provided adequate surgical care at the combat beachhead.



SUBUNGUAL PIGMENTATION FOLLOWING PROLONGED ATABRIN THERAPY

The presence of a lemon yellow pigmentation of the skin following atabrin therapy is common, the degree of pigmentation varying greatly in different individuals. In a few persons another type of pigmentation has been observed.

After more than a year of continuous suppressive atabrin therapy about two percent of a certain Marine unit had developed peculiar bluish areas underneath the fingernails and the toenails. The discoloration appears first at the lateral sides of the nail bed and later extends toward the center, in many instances forming a dark blue line entirely across the nail bed following the vascular loops.

The finding is not unlike that seen in contusions and subungual petechial hemorrhages, but lacking clinical evidence these conditions are excluded. There is no pain nor tenderness and all of the nails are similarly affected. Blood dyscrasias are ruled out by entirely negative results of blood study.

The subungual marking was noted in those persons in whom yellow pigmentation of the skin was observed. Discontinuance of the drug for about one month results in nearly complete clearing of the condition.

This observation is reported more with the thought that recognition of the sign will prevent confusion with other pigmentary processes than that any special intrinsic significance should be attached to it.—BARR, J. F., Lieutenant Commander (MC) U. S. N. R.

MEDICAL EXPERIENCES ON AN APD

WILLIAM S. GEVURTZ

Lieutenant Commander (MC) U.S.N.

and

ALBERT J. MICHEL

Chief Pharmacist's Mate, U.S.N.R.

Four-stack destroyers have been converted into high-speed transports (APDs) for employment in the transportation of troops on raiding missions and to beachhead areas, and for evacuation of casualties to hospitals in the back area. The medical department problem involved in this new use of the destroyer differs in many essential aspects from ordinary transport organization. Organizational plans and the conduct of the medical department in preparation for, during, and after landing operations do not fit into standard categories on these ships which are half destroyer and half transport.

PROBLEMS

1. There are sanitary problems resulting from general overcrowding of the ship, because of the presence of troops (usually in excess of the rated capacity) and the increased operating personnel with resultant inadequacy of sanitary facilities. (The officer complement has been increased 100 percent and the enlisted 50 percent over the original intended complement.)

2. Medical supplies are drained and personnel taxed in caring for the routine sick call requirements when troops are aboard for a period of days.

3. Preparations for battle include medical responsibilities.

4. Securing of casualties from the beach adds to the problem.

5. Casualties from the ship's company, beachheads, or sunken vessels require immediate treatment.

Sanitary problems.—The first problem is extremely difficult. The zeal of the medical officer brings him into opposition with the first lieutenant and engineering officers and certainly his ideals are going to receive considerable buffeting by the realities of the situation. What the medical officer sees is that if one member of the crew or troops gets catarrhal fever or a sore throat, half or more of the crew and troops may follow. He fears an epidemic which will put the ship out of action or decrease the effectiveness

of a combat team. He remembers that there are just so many cubic feet of space on the ship and when troops are aboard most of it is occupied. On the other hand, the engineer is concerned about the capacity of his water condensers and the wear and tear on his blowers and generators. The medical officer must do all that he can to control the situation.

Certain measures are at once obvious: The medical officer can make it his business to see that all food is prepared and served in a cleanly manner. He can become a fanatic on the subject of mess gear and insist (to the first lieutenant's consternation) that all cracked or chipped porcelain cups and plates be surveyed and that all metal tureens and silverware be scrupulously clean. He must keep a wary eye on the "coffee watches" to see that all do not drink in rotation from the same cup. The crew must be encouraged to come to him with minor ailments in order to stop, at their inception, the spread of colds and other disorders. His preachment of personal hygiene must be repetitious.

APDs are old ships employed mostly in forward areas. Keeping them clean is a battle against rust and dirt. Cockroaches cannot be completely eliminated, and only with constant spraying with appropriate roachicides will they be kept under control. Whenever one reaches a port in which facilities for fumigation are available, this should be done; but APDs do not ordinarily get into such ports.

It is difficult to use isolation technic for colds, sore throats, and slight contagious infections, but a modified isolation in the troop space can and must be enforced. We have stopped a number of "cold" epidemics by this procedure and by having the mess cooks sterilize their gear in the galley pressure cooker between meals.

The medical needs of troops carried aboard an APD differ in many respects from those on a large transport. The sickbay is small; it has no beds strictly devoted to patients, and everything is tightly packed. It is a good practice to arrange with the medical officer or senior aid man of troops aboard for special sick calls during the day for routine and minor care. In order to prevent crowding, a time may be set for each platoon. Emergencies, to be sure, are taken care of at any time.

Supplies.—The presence of troops means that we must carry enough supplies on hand at all times to take care of both troops and crew. This represents more than double the amount required for ship's personnel alone and requires that the medical officer give considerable attention to his medical supply orders, both that he may not be overstocked and that he will not find himself missing essential items in the midst of an operation.

There is also a considerable problem in stowage. It is advisable to establish three stowage areas: One in the forward crew's quarters where the former main sickbay was located; one in the troop space which now serves as the main sickbay; and one located aft where there are two fair-sized lockers. In addition to ordinary supply bookkeeping, a directory is kept listing the location and quantity of supply in each stowage. Only the supplies in the main sickbay are used directly for sick call, and these are replenished once weekly from the after and forward stowage. When supplies of any category reach an order point for that item, they automatically go on the order list. Careless bookkeeping methods will be a hindrance to the medical officer of an APD whose needs vary in amount and type of supplies.

Battle preparation.—1. Camouflage: The medical officer of an APD must learn to anticipate unusual medical requests. For example men who are going on a beachhead or raiding mission do not want a white dressing on their injuries which will give enemy snipers a gleaming point of aim. The green face and hand dye which is available to raiding parties is suitable to blend a dressing, large or small, with the rest of the camouflage. This means that the medical officer should study the military problem and prepare himself for what he is most likely to be called on to do.

2. Station assignments: At general quarters the senior pharmacist's mate takes station in the after battle dressing station and covers the after third of the ship. The junior hospital corpsmen proceed to the sickbay, prepare from 20 to 30 beds in the troop space for casualties, lay out supplies and instruments, and get stretchers of both the Stokes and Army pole type ready for use. The medical officer and junior hospital corpsmen man the amid-ship battle dressing station and cover the forward two-thirds of the ship.

3. Distribution of personnel: The evaluation of the extent of any given casualty is made in the main battle dressing station. One of the difficulties has been to get adequate help while working under combat conditions and still maintain distribution of medical department personnel. The allowed complement of one medical officer and one pharmacist's mate is inadequate for the needs of the ship under present conditions. Recently a pharmacist's mate, second class, has been authorized. This may relieve the situation. Most APDs have found it necessary to have from one to three pharmacist's mates in excess in order to meet unanticipated situations adequately.

4. Supplementary first aid: Throughout the ship, at convenient

points, there should be a number of first-aid bags and lockers, each containing battle dressings, bandages, tourniquets, sulfa powder, splints, and morphine Syrettes. All the crew should be given a minimal amount of first-aid instruction and about 20 of the most promising, a complete first-aid course. These men are stationed about the ship during general quarters so that no area is left uncovered. Frequent casualty drills with simulated casualties help train these first-aid men. They should be encouraged to visit the sickbay when injuries are being treated, so that they can observe the actual use of the principles taught. Officers are given a course in first aid and each carries a small kit at general quarters containing dressings, morphine, tourniquets, and sulfa powder.

Three of our most interested crew members received an indoctrination in minor nursing. They constitute a sort of APD version of a nurse's aid to supplement the duties of the trained hospital corpsman. Their services proved invaluable in the management of several large groups of casualties which our ship transported.

5. Drill: Regular drill is held in the laying out of supplies and in other preparations for battle, timed by stop-watch, with a view to reducing the time required to accomplish a task. In our case the reduction in time for this purpose has been from an initial 40 minutes to an irreducible minimum of about 3 minutes.

6. Rigging of stretchers: Ships must be rigged for carrying stretchers, so that they ride easily and occupy a minimum of space. There is a standard system of chains used. The chains are swung laterally across the ship, so that three stretchers can be accommodated forward of the engine and three stretchers on the deck in similar position. This gives a capacity of six stretchers per APD. Ambulatory patients can be accommodated fore and aft and do not constitute a problem.

7. Unloading and sorting: If on the beach, the medical officer must see that someone, a trained officer or pharmacist's mate, supervises the unloading at the ship and acts as a sorting officer to separate those casualties requiring immediate attention from those already definitively treated on the beach. A party of stretcher-bearers must be on hand rapidly to empty the boat carrying the casualties to the APD so as to permit its return for as many loads as necessary.

8. Beach stretcher and blanket supplies: When the medical officer goes to the beach, he should take with him a plentiful supply of stretchers and blankets, as shore facilities will insist on replacements. It is not wise to wait to find how many will be

needed. An adequate amount should be taken along on the first trip. The medical officer will have received estimates of the number of casualties in advance, but these must be considered subject to change. A bomb may hit an hour before arrival and triple the expectations.

9. TBY and binoculars: It is advantageous for the medical officer to have with him a TBY for communication with the ship, and binoculars to survey the shore. As he goes in, he should look carefully for the red cross which will be used to mark the main evacuation beach, but he should study the landmarks elsewhere as well, as he will frequently be asked to go to pick up patients who cannot be brought to him. The tactical situation in new beachheads changes hourly and the medical officer must accommodate given plans to these changes. Inattention and inflexibility will invite disaster. Through the TBY the ship can be informed of changing situations and frequently the commanding officer can thus be aided with information that indicates the medical officer's progress.

Removal of patients from boats.—Various procedures for getting the patient out of the boat are employed by different ships of the APD division. We hoist the boats to the rail, a matter of seconds, and hand the stretchers over the deck. This can be accomplished quickly, especially after preparatory drilling during which each man is impressed with his job.

Removing casualties from beach.—As an APD medical officer, it is often necessary to assume the responsibility of evacuating casualties from beachheads or raiding missions to back-area hospitals. It may be necessary for the medical officer to go to the beach to supervise assembly and loading. In new active beachheads each one is too busy with his own duties to give the medical officer help or direction, so that he will have to manage with the aid of beach medical facilities. The job must be done expeditiously, because the APD will be an easy target as it is lying to, until the medical officer returns with casualties.

Newcomers to APD medicine are cautioned against removing a man from the raiding or beach party unless absolutely convinced that both his best interest and the success of the mission will be hampered by his presence. There will be men with sore ankles and backs, and cuts and bruises, and men who are just plain scared. If the troops have a medical officer, it is well to decide in consultation what to recommend to senior troop officers. If there is no troop medical officer, it is the responsibility of the APD medical officer to see that every bit of fire power that can

be brought to bear on the enemy goes ashore, minor ailments notwithstanding.

Reception of battle casualties.—Preparation for the reception of battle casualties either from ships or from the beach requires careful planning. It is well to have available three battle dressing stations: The main sickbay amidship in the troop space; the crew's washroom aft; and the crew's forward living spaces. In each there is ample material for the care of casualties within the limit of the manpower capacity, although it is our policy to bring all injured to the main sickbay.

• TREATMENT

If the sorting officer or pharmacist's mate has been on the job and the minor casualties are in the lower troop space and those requiring attention are in the upper troop space, then the medical officer is ready to wash his hands and begin treatment.

Proportion and types of casualties.—We have had aboard the APD 125 casualties for transport in the period from October 1943 to February 1944. If this figure appears small, the limited facilities should be borne in mind. Of these patients, 47 had wounds and injuries, 41 burns, and 37 were ill. There was 1 death aboard. The man died within an hour after he was brought aboard. He had been severely burned.

Wounds and injuries.—The wounds and injuries were treated in continuation of therapy begun on the beach and were given definitive treatment when possible. Wounds requiring it were cleansed, sulfathiazole was introduced or continued, and tetanus boosters were given.

It was not considered advisable to close wounds or employ extensive debridement. Follow-up has indicated that the patients did well in the later stages of their convalescence. The only exception was in one case of hemopneumothorax which was closed to prevent sucking.

Burns.—All patients with burns were given sulfadiazine, and tetanus boosters. The burn cases occurred in survivors of a sunken vessel and the burns were received while the men swam through burning oil. The burns were extensive and most of the patients exhibited severe shock. All patients in shock were given plasma. It is not practical on a small ship to debride burns; a pressure dressing over a sulfathiazole ointment has been satisfactory.

Fractures.—Many of the fractures had been given definitive treatment on the beach; if not, a modified debridement followed by application of a cast was employed aboard ship.

Hemorrhages.—There were no hemorrhages that could not be controlled by dressings or hot sponges.

Plasma.—The importance of large doses of plasma cannot be overemphasized. We do not have hematocrits to determine the amount of plasma which should be used, but simple clinical observation has had to serve as a guide, at least in the early stages of treatment.

We had to use 130 units of plasma for 38 men in a 3-hour period. The patients arrived at the hospital in good condition.

Fluids.—The combination of shock and burns frequently makes it difficult to find veins for venous administration of fluids. One should be prepared to expose veins by incision when necessary. All medical officers should familiarize themselves with the technic of sternal puncture and penile instillation of fluids, so that these measures may be employed.

Illnesses.—The illnesses consisted chiefly of psychoneuroses, malaria, and filariasis. The patients in the first group were given large doses of barbiturates and allowed to sleep almost continuously until debarkation. The marked improvement which this procedure produced in their outlook and general condition gave promise that with early sedative therapy there was an excellent chance of eventual restoration to duty.

Antimalarial therapy was begun or continued for the malarial group. Filariasis patients were allowed to rest or were utilized to clean and feed other patients.

PRACTICAL SUGGESTIONS

To overcome the hindrance of the pitching and rolling of the ship during surgery, holes for rings may be drilled in the operating table and canvas strips having fasteners may be drawn through the rings. The operator may hold himself to the table with these canvas strips. This device can be made by the ship-fitters without difficulty.

A final caution to medical officers on independent duty of the APD variety is not to hesitate to call for help. The APD will usually be in company with several other APDs which will be glad to send their medical officers, pharmacist's mates, or supplies. It is not an admission of weakness to call for help in difficult situations but rather a recognition of a problem.

HOSPITAL SHIP IN AMPHIBIOUS ACTION

FRANK F. WILDEBUSH
Commander (MC) U.S.N.R.

and

JAMES E. CLIMER
Chief Pharmacist's Mate U.S.N.

This statistical report is submitted because it is thought to be of interest as a summary of medical activity of a hospital ship during action. It represents the entire casualty list of a single phase of a combined amphibious operation, and calls attention to the various problems and the volume of work entailed in caring for recent battle casualties, indicating what may be anticipated by the medical staff in this kind of war operation.

The casualties were all received from the personnel engaged in a recent operation against an organized enemy. Some were received within an hour after being injured, and some as late as 48 hours. All of the casualties were sent to this activity.

There were 607 casualties received aboard, of whom 576 were United States Army and Navy casualties and 31 were captured wounded Japanese troops. Of the total of 607, there were 17 medical patients, including 2 cases of dementia praecox. No case of war neurosis was received in this initial stage of combat.

There were 590 patients with war injuries. The types of injury and the number of each type follows:

Gunshot wounds	169
Shell fragment wounds.....	329
Burns	7
Blast concussion injuries.....	13
Injury from accidents.....	41
Bayonet wounds	3
Saber cuts	1
Plane crash injury.....	1

An anatomic classification of injury revealed:

Craniocerebral injuries	10
Cord injuries	3
Head and neck injuries.....	110
Chest—intrathoracic injuries.....	41
Abdominal—perforating injuries	19
nonperforating injuries	12

Extremities—upper injuries	220
lower injuries	181
Back injuries	37
Eye injuries	17
Penis injury	1

It is seen that of the patients:

- 66 percent had injuries of the extremities
- 20 percent had head and neck injuries
- 10 percent had chest injuries
- 5 percent had abdominal injuries
- 5 percent had back injuries
- 2.8 percent had eye injuries

The overlapping percentages reveal multiple injuries.

All of these casualties were received in a period of 36 hours. The bulk of the operative treatment was performed within 72 hours after the first patient was received aboard.

The following operative procedures were performed:

Exploratory laparotomies	13
Amputations	8
Extensive debridements with closure.....	80
Extensive debridements without closure.....	53
Nephrectomy	1
Eye operations	11
Craniotomies	5
Application of plaster casts.....	33

This represents immediate and early treatment given to recent battle casualties received aboard a hospital ship for further transportation to a base hospital.

Over 500 roentgenographs were taken on 256 patients. In addition 21,000 cc. of whole blood was administered to 42 patients, and 432 units of blood plasma were given to a greater number. Nine million units of penicillin were given.

There were 18 deaths from the following causes:

Intra-abdominal injuries	10
Brain and cord injuries.....	5
Intrathoracic injuries	2
Multiple injuries	1

In the organization of the staff of a hospital ship during a combat operation, every medical officer and dental officer is a member of a surgical team. In this way, the preoperative and postoperative care of patients is greatly facilitated.

PATHOGENIC ENTERIC BACILLI¹

II. THE SALMONELLA GROUP

LAVERNE A. BARNES

Lieutenant Commander H-V(S) U.S.N.R.

The first article in this series (1) dealt with three groups of bacilli for which there is some evidence of ability to initiate gastro-intestinal disease. It is now proposed to discuss the salmonellas, which include a rather long list of organisms of established pathogenicity. Certain bacteriologic characteristics of the group, together with recommended procedures for preliminary identification in field laboratories, were described in an earlier publication (2). In the present communication additional information concerning epidemiologic, clinical, and serologic considerations will be submitted. It is hoped that interest in the salmonella group will be stimulated, and that those concerned with the health of Naval personnel may recognize the importance of enteric disease due to these organisms.

NOMENCLATURE

The terms "paratyphoid" or "paratyphoid fever" are no longer tenable since such phraseology is too restricted and ambiguous; there are now listed nearly 180 salmonella types, of which the paratyphoid bacilli (A, B, and C) represent only a small proportion of the entire group.

It is preferable to refer to infections caused by the members of the group as the salmonelloses and when the infecting type is determined to designate the organism by its specific name. With a few exceptions (such as *S. paratyphi* A, *S. hormaechei*, *S. berta*, etc.), the salmonella types have been given specific names corresponding to the locality in which they were first found; thus there are *S. derby*, *S. panama*, *S. san-diego*, and so on. Certain types have been known under a variety of names; *S. typhimurium* (which is still misleading) has been previously designated as *pestis-cavae* and *aertrycke*; *S. cholerae-suis* was for-

¹ This is the second of a series on enteric bacilli by Lt. Comdr. LaVerne A. Barnes H-V(S) U.S.N.R. The first of this series appeared in the October number.

merly known as *suipestifer* or the hog-cholera bacillus. It is possible that other changes will be made later but for the present the names shown in the accompanying lists are those officially recognized.

It should be emphasized that although it is contrary to tradition, the "typhoid bacillus" is properly a member of the salmonella group; this is true by definition and, as will be shown below, *S. typhi* (*E. typhosa*) is only one member of a group of salmonellas that are capable of producing a certain syndrome of clinical symptoms.

SALMONELLA INFECTIONS IN MAN

A point of considerable importance from the clinical, epidemiologic, and bacteriologic standpoints is the growing and justifiable tendency to classify the salmonelloses on the basis of the nature of the infections in humans (3) (4) (5). It is desirable, therefore, to think in terms of: (a) Enteric fever; (b) acute gastroenteritis; and (c) the carrier infection.

Enteric fever.—Under this heading are included those infections manifested by a continued fever of the enteric type in which there is an *early* invasion of the blood stream by the organisms; as such the "typhoid bacillus" is only a classical example of a group of bacilli producing the familiar syndrome, rather than a separate clinical entity. It should be noted that the important differential diagnostic point in *enteric fever* is the characteristic and early penetration of the organisms into the blood stream, and that the symptoms of fever, malaise, headache, loss of appetite, sleeplessness, etc., are associated with the bacteriemia; the appearance of symptoms may be from 7 to 14 days after ingestion of the organisms. From the standpoint of laboratory diagnosis, blood cultures taken as soon as symptoms appear are more likely to yield positive results than are stool cultures; stool cultures become the method of choice later in the course of the disease after the organisms have become localized in the intestinal mucosa and, following multiplication there, are excreted in the feces.

Other localizations may occur following the bacteriemia (or septicemia) as listed by Bornstein (5); the pathologic conditions mentioned include endocarditis, pericarditis, meningitis, osteomyelitis, arthritis, rhinopharyngitis, sinusitis, pneumonia, pleurisy, peritonitis, cholecystitis, pyelonephritis, and abscesses. The types listed as being involved in these local manifestations are: *S. abortus-equi*, *S. bredeney*, *S. cholerae-suis*, *S. enteritidis*, *S. lomalinda*, *S. london*, *S. panama*, *S. paratyphi B*, *S. potsdam*, *S.*

senftenberg, S. thompson, and S. typhi-murium. S. typhi was omitted from the list although it is known to establish local foci in certain organs of the body.

A compilation of the various lists of salmonellas reported as incitants of enteric fever is presented for information; for this purpose, salmonella fever and salmonella septicemia have been interpreted to be in the same category as enteric fever.

S. abortus-bovis B	S. anatum	S. bareilly
S. blegdam	S. bovis-morbificans	S. brandenburg
S. carrau	S. cholerae-suis	S. derby
S. eastbourne	S. enteritidis	S. habana
S. infantis	S. kaapstad	S. montevideo
S. narashino	S. newington	S. newport
S. onarimon	S. oranienburg	S. panama
S. paratyphi A	S. paratyphi B	S. paratyphi C
S. reading	S. saint-paul	S. san-diego
S. sendai	S. senftenberg	S. stanley
S. thompson	S. typhi (E. typhosa)	S. typhi-murium
S. virchow		

No attempt has been made to tabulate the incidence of these 34 types because data permitting statistical analysis are not available; one of the sources of information failed to include those infections due to S. typhi. The types are listed alphabetically for the sake of more convenient reference.

Acute gastro-enteritis.—In this condition, as contrasted with enteric fever, bacteriemia is of secondary importance and presumably occurs only after an extended infection of the intestinal mucosa has led to late ulceration; such instances are rare, particularly in adults. In this form of salmonellosis, nausea and vomiting are usually the first symptoms but may be absent; diarrhea is a predominating, early symptom and abdominal cramps are frequently noted; blood is rarely found in the stools. The incubation period is usually short, varying from 6 to 72 hours with the average time of onset of symptoms about 10 to 18 hours after exposure. Fever usually subsides rather promptly and the disease ordinarily does not last longer than a week; the fatality rate in adults is negligible. Using the same sources of published data as for enteric fever, 75 types of salmonellas have been reported to be etiologic agents in acute gastro-enteritis. These are listed on the following page.

Carriers.—The question of carriers of salmonellas presents a complex problem. Although the majority of the salmonelloses are primarily of animal origin, the role of the transitory or chronic human carrier is of considerable importance particularly in re-

S. aberdeen	S. abortus-equi	S. altendorf
S. amager	S. amersfoort	S. anatum
S. arechavaleta	S. ballerup	S. bareilly
S. berta	S. bispebjerg	S. bovis-morbificans
S. braenderup	S. brandenburg	S. bredeney
S. budapest	S. carrau	S. chester
S. cholerae-suis	S. claibornei	S. derby
S. duesseldorf	S. durban	S. eastbourne
S. enteritidis	S. essen	S. exeter
S. florida	S. gaminara	S. give
S. glostrup	S. hartford	S. heidelberg
S. hvittingfoss	S. javiana	S. kaposvar
S. kentucky	S. kirkee	S. kottbus
S. lexington	S. litchfield	S. london
S. manhattan	S. meleagridis	S. montevideo
S. muenchen	S. newington	S. newport
S. niloese	S. nyborg	S. oranienburg
S. oslo	S. panama	S. paratyphi B
S. paratyphi C	S. poona	S. potsdam
S. pueris	S. pullorum	S. reading
S. saint-paul	S. san-diego	S. schleissheim
S. sendai	S. senftenberg	S. stanley
S. thompson	S. tim	S. typhi-murium
S. urbana	S. vejle	S. virchow
S. weltevreden	S. wichita	S. worthington

gard to those organisms capable of producing enteric fever and in connection with food handlers who may show only subclinical symptoms while disseminating the bacilli. The length of time that an infected person may remain a "healthy" carrier is obscure; undoubtedly it varies considerably depending upon the type of salmonella and the physiologic peculiarities of the individual concerned.

It is well-known that carriers of *S. typhi*, *S. paratyphi B*, and probably other types involved in enteric fever may harbor the organisms for very long periods of time and so remain a public health menace. It is likely that, for the most part, carriers of those types of organisms that are found predominantly in acute gastro-enteritis are characteristically transitory in nature. Of importance in this regard is the finding (5) that "the stools of healthy persons in the environment of salmonella infections may contain the organisms for unknown, probably short periods of time." The facts in the problem argue in favor of the urgent necessity for extensive bacteriologic studies on stools of food handlers and of large samples of populations in which sporadic cases of diarrhea occur. The following list shows those types that have been found in carriers; most of the instances were recorded as normal carriers. It is of importance to note, however, that

many of the types have also been shown to be the cause of enteric fever or gastro-enteritis:

S. abony	S. anatum	S. bareilly
S. bonariensis	S. bredeney	S. budapest
S. california	S. carrau	S. chester
S. derby	S. georgia	S. give
S. inverness	S. javiana	S. litchfield
S. manhattan	S. mississippi	S. montevideo
S. newington	S. newport	S. onarimon
S. oranienburg	S. oregon	S. panama
S. paratyphi A	S. paratyphi B	S. senftenberg
S. simsbury	S. tennessee	S. typhi
S. typhi-murium	S. urbana	S. worthington
S. zanzibar		

Miscellaneous human infections.—In addition to the three categories given above, there are a few salmonella types that have been reported to cause human infection, but for which there is insufficient information to designate to which group they belong. These include the following strains: S. cerro, S. dar-es-salaam, S. moscow, S. muenster, S. onderstepoort, S. rubislaw, S. selandia, S. shangani, and S. uganda.

It should be remembered that, as more information is collected, the status of the established types may be altered. It is true also that new types are being found and their position will need to be determined later.

SALMONELLAS FOUND ONLY IN ANIMALS

Although there are a few salmonella types, such as S. typhi, S. paratyphi A, S. paratyphi B, S. sendai, etc., that are primarily human infections, by far the richest reservoir of salmonellas is found in the lower animals used for food. In some instances the animals harboring the organisms may show pathologic processes attributable to the localization of bacilli in certain organs of the body but in other cases no evidence of infection may be detected. There are a certain number of types which, up to the present time, have been reported as found only in animals; these are listed below because their importance lies in the fact that they must be considered as potential etiologic agents in human salmonellosis:

S. abortus-bovis A	S. abortus-ovis	S. amherstiana
S. concord	S. dublin	S. gallinarum
S. hormaechei	S. illinois	S. madelia
S. mikawashima	S. minnesota	S. new-brunswick
S. pomona	S. pretoria	S. rostock
S. salinatis	S. tel-aviv	S. typhi-suis

As mentioned in a previous publication (2) the utilization of d-tartrate has been believed to indicate the animal source of a salmonella. This opinion is open to serious question; the identification of type by serologic means, however, will lead to the same information in that on the basis of data already accumulated the most predominating animal source can be ascertained. A list of the most commonly encountered types in human infections and their usual animal source is given below.

DISTRIBUTION OF TYPES

The following 24 salmonella types listed in the order of their frequency in man are assigned to rank upon the basis of their occurrence in outbreaks; the reason for this method is obvious in that it gives a more accurate representation of the true distribution than a listing by cultures identified, since a large number of cultures may be isolated from a single outbreak. This compilation was selected from the data published by Edwards and Bruner (4) based on typings at the National Salmonella Center; although there are other data available it has not been clear whether the type-distribution was based upon outbreaks of infection or whether the evidence represented total numbers of cultures. It is believed, however, that the data given here is a fair cross-section of the type-distribution in the United States; figures on cultures isolated outside this country are at the present inadequate but some valuable data appeared recently concerning the types found in Uruguay (6) and Australia (7).

TABLE 1.—Types listed in order of frequency in man

Type	Human outbreaks	Animal outbreaks	Total
<i>S. paratyphi B*</i>	51	Fowls, 4; others, 2	57
<i>S. typhi-murium</i>	50	Fowls, 472; others, 105	627
<i>S. newport</i>	33	Fowls, 19; others, 7	59
<i>S. cholerae-suis</i>	30	Swine, 272; others, 32	334
<i>S. panama</i>	20	Fowls, 6; others, 1	27
<i>S. montevideo</i>	17	Fowls, 11; others, 3	31
<i>S. typhi*</i>	17	0	17
<i>S. oranienburg</i>	13	Fowls, 28	41
<i>S. san-diego</i>	13	Fowls, 3; others, 1	17
<i>S. bareilly</i>	11	Fowls, 47; others, 7	65
<i>S. anatum</i>	10	Fowls, 44; others, 12	66
<i>S. enteritidis</i>	8	Rodents, 12; others, 7	27
<i>S. paratyphi A*</i>	7	0	7
<i>S. bredeney</i>	7	Fowls, 27; others, 6	40
<i>S. give</i>	6	Fowls, 18; others, 7	31
<i>S. senftenberg</i>	4	Fowls, 15; others, 4	23
<i>S. meleagridis</i>	3	Fowls, 15; others, 1	19
<i>S. oregon</i>	3	Swine, 5; others, 2	10
<i>S. derby</i>	2	Fowls, 33; others, 9	44
<i>S. saint-paul</i>	2	Fowls, 1	3
<i>S. thompson</i>	2	Fowls, 1	3
<i>S. sendai</i>	2	0	2
<i>S. pullorum</i>	2	Fowls, 492; others, 3	497
<i>S. newington</i>	2	Fowls, 18; others, 4	24

*Probably inaccurate due to incomplete records.

An outstanding feature of the brief list of salmonella types according to their sources (table 1) is that *fowls* are by far the main animal reservoir of organisms affecting man; this is a point that cannot be overemphasized, since it may often aid in solving the origin of an outbreak of salmonellosis. On the other hand it must also be remembered that human carriers are of considerable importance in the initiation of outbreaks and that a food handler may well become a carrier of salmonellas, even though his condition may be transitory in nature, and so start an epidemic. For further discussions along these lines reference is made to published data of Edwards and Bruner (4), Bornstein (5), and Borman, Wheeler, West, and Mickle (8).

PREVENTIVE MEASURES

Means of preventing outbreaks of salmonellosis may be classified into two main categories: One depends upon rigid environmental sanitation, the other involves a knowledge of the bacteriologic, serologic, and epidemiologic characteristics of the organisms that may be concerned. The two groups of factors are, obviously, interrelated.

Environmental sanitation.—The general measures recommended have been enumerated in various publications (9) (10) (11): These may be summarized as follows: (a) Proper storage and refrigeration of all fresh foods and meats; (b) thorough cooking of meat products (particularly fowls) and adequate refrigeration after cooking if not consumed immediately; (c) protection of all foods from rats, mice, flies, and other vermin; (d) thorough cleanliness of galleys, cooking gear, and eating utensils; (e) complete instructions to all food handlers on the importance of personal hygiene, with especial emphasis on proper handwashing after visiting the head; (f) discovery and supervision of carriers and their exclusion from handling food—food handlers with gastro-intestinal disturbances should be relieved from duty until they have been symptom free (including bacteriologic study) for 1 week; (g) proper disposal of human excreta.

Characteristics of the organisms.—The common sources of salmonellas affecting man have been mentioned above. In addition to the general preventive measures just listed, it is urgent that surveys or routine examinations of fecal specimens be made in order to determine the prevalence and incidence of salmonella types; remarkable opportunities now exist in Naval establishments for conducting such studies. It is requested that all laboratories equipped to carry out bacteriologic work increase efforts

toward the isolation of members of the salmonella group; when such organisms are isolated, they should be forwarded to the Enteric Pathogen Laboratory, U. S. Naval Medical School, Bethesda, Maryland, where serologic identification of the exact type will be made. Epidemiologic information concerning the circumstances surrounding isolation of cultures should be included in the letter of transmission of specimens. Reports of the typing of salmonellas will be returned to the activity concerned.

The present status of salmonella typing is such that the work must be done by specially trained personnel since the identification depends upon rather complex serologic manipulations. The supplies of sera are not yet adequate to be furnished to all laboratories and probably will not be within the near future. The advantages of centralizing the data accumulated in the field are manifold and justifiable. The information derived from a widespread study of type-incidence would be of great value, not only in regard to present outbreaks that occur but for later utilization. If the exact type is determined, it usually will indicate the probable origin of strains responsible for the outbreak and so point the way to preventing subsequent infections due to the same organism. Another important result of type-identification is that the information obtained may well aid in devising more effective prophylactic inoculation procedures against salmonellosis. To achieve these objectives, it is necessary that cultures from various parts of the world—particularly in the combat areas—be collected and typed.

That such a program can succeed is illustrated by the reports of Borman et al. (8), Hormaeche and colleagues (6), Rubenstein, Feemster, and Smith (12), Adams and Atwood (13) and others. The evidence indicates that salmonella infections are more prevalent than is commonly supposed and that alertness and careful studies will be of great value from the standpoint of preventive medicine. It may appear to some that the large number of salmonella types presents a problem too complex to solve, but the very multiplicity of types emphasizes the need for accurate bacteriologic and serologic studies. The use of polyvalent "typhoid-paratyphoid-dysentery" antisera should be avoided since the results obtained are inadequate and misleading; a negative outcome does not necessarily mean that the organism is not a member of the enteric group; a positive test does not determine the exact type nor does it always mean that the species tested is even a pathogen since salmonellas may share antigenic components with other enteric bacilli (14) (15). Antigenic analysis of each individual strain is required for the determination of type.

THE SALMONELLA TYPES

In order that a ready reference of the established salmonella types may be generally available to Naval personnel, an alphabetical list is given below. One hundred thirty-one types are shown; the balance of a complete list represents strains with minor serologic or other characteristics.

S. aberdeen	S. abony	S. abortus-bovis
S. abortus-equi	S. abortus-ovis	S. adelaide
S. altendorf	S. amager	S. amersfoort
S. amherstiana	S. anatum	S. arechavaleta
S. ballerup	S. bareilly	S. berta
S. bispebjerg	S. blegdam	S. bonariensis
S. bovis-morbificans	S. braenderup	S. brandenberg
S. bredeney	S. budapest	S. california
S. cardiff	S. carrau	S. cerro
S. chester	S. cholerae-suis	S. claibornei
S. concord	S. coeln	S. dar-es-salaam
S. derby	S. dublin	S. durban
S. duesseldorf	S. eastbourne	S. enteritidis
S. essen	S. florida	S. gallinarum
S. gaminara	S. give	S. glostrup
S. goettingen	S. grumpensis	S. infantis
S. inverness	S. habana	S. hartford
S. heidelberg	S. heves	S. hormaechei
S. hvittingfoss	S. illinois	S. javiana
S. kaapstad	S. kaposvar	S. kentucky
S. kirkee	S. kottbus	S. lexington
S. litchfield	S. loma-linda	S. london
S. madelia	S. manhattan	S. meleagridis
S. mikawashima	S. minnesota	S. mississippi
S. montevideo	S. moscow	S. muenchen
S. muenster	S. narashino	S. new-brunswick
S. newington	S. newport	S. niloese
S. nyborg	S. onarimon	S. onderstepoort
S. oranienburg	S. oregon	S. oslo
S. panama	S. paratyphi A	S. paratyphi B
S. paratyphi C	S. pomona	S. poona
S. potsdam	S. pretoria	S. pueris
S. pullorum	S. reading	S. rostock
S. rubislaw	S. saint-paul	S. salinatis
S. san-diego	S. schleissheim	S. selandia
S. sendai	S. senftenberg	S. shangani
S. simsbury	S. stanley	S. solt
S. sundsvall	S. swartzengrund	S. szentes
S. taksony	S. tel-aviv	S. tennessee
S. thompson	S. tim	S. typhi
S. typhi-murium	S. typhi-suis	S. uganda
S. urbana	S. vejle	S. virchow
S. weltevreden	S. wichita	S. worthington
S. zagreb	S. zanzibar	

SUMMARY

It is pointed out that the terms "paratyphoid bacilli" and "paratyphoid fever" should be discarded in favor of salmonellas and salmonelloses respectively since the former names are restricted, ambiguous, and obsolete.

A brief discussion of human salmonellosis emphasized the opinions that (a) so-called "typhoid fever" is only one example of a disease presenting a syndrome of symptoms more properly designated enteric fever; (b) there are a large number of salmonella types that may give rise to acute gastro-enteritis; and (c) several of the salmonella types have been found in human carrier conditions.

Lists of organisms in these various categories were presented for information. It was shown, also, that while the majority of salmonellas are of animal origin, and that there are a few types that so far have been found only in lower animals, the possibility of transfer from human to human should not be overlooked.

Certain evidence regarding the distribution of types in outbreaks of human infection was presented and the usual animal sources designated; of great importance is the fact that fowls are the main source of human salmonellosis.

The urgent need for extensive and intensive bacteriologic and serologic studies in connection with preventive medicine was emphasized.

A list of the types of salmonellas known at the present time was given for reference.

REFERENCES

1. BARNES, L. A.: Pathogenic enteric bacilli. I. Paracolon, proteus, and pseudomonas groups. U. S. Nav. M. Bull. 43: 707-716, October 1944.
2. Ibid.: Identification of Salmonella cultures. U. S. Nav. M. Bull. 41: 1184-1188, July 1943.
3. TOPLEY, W. W. C., and WILSON, G. S.: The Principles of Bacteriology and Immunity. 2d edition. William Wood & Co., Baltimore, 1938. pp. 1202-1203.
4. EDWARDS, P. R., and BRUNER, D. W.: Occurrence and distribution of salmonella types in United States. J. Infect. Dis. 72: 58-67, January-February 1943.
5. BORNSTEIN, S.: State of salmonella problem. J. Immunol. 46: 439-496, June 1943.
6. HORMAECHE, E.; SURRACO, N. L.; PELUFFO, C. A.; and ALEPPO, P. L.: Causes of infantile summer diarrhea. Am. J. Dis. Child. 66: 539-551, November 1943.
7. ATKINSON, N., and WOODROOFE, G. M.: Occurrence of Salmonella types in Australia. Australian J. Exper. Biol. & M. Sc. 22: 51-55, March 1944.

8. BORMAN, E. K.; WHEELER, K. M.; WEST, D. E.; and MICKLE, F. L.: Salmonella typing in public health laboratory. *Am. J. Pub. Health* 33: 127-134, February 1943.
9. Manual of the Medical Department, U. S. Navy, Appendix D. April 1, 1941. pp. 28-29.
10. CARTER, T. J.: Outbreak of food infection. *U. S. Nav. M. Bull.* 41: 1183-1184, July 1943.
11. Notes on Tropical and Exotic Diseases of Naval Importance. U. S. Naval Medical School, National Naval Medical Center, Bethesda, 1943. p. 23.
12. RUBENSTEIN, A. D.; FEEMSTER, R. F.; and SMITH, H. M.: Salmonellosis as public health problem in war time. *Am. J. Pub. Health* 34: 841-853, August 1944.
13. ADAMS, J. W., JR., and ATWOOD, R. T.: Bacillary dysentery; bacteriologic and clinical analysis of 251 cases occurring in an army camp. *War Med.* 5: 14-20, January 1944.
14. BORNSTEIN, S.; SAPHRA, I.; and DANIELS, J. B.: Occurrence of Salmonella antigens in dysentery bacilli. *J. Immunol.* 42: 401-404, December 1941.
15. WHEELER, K. M.; STUART, C. A.; RUSTIGIAN, R.; and BORMAN, E. K.: Salmonella antigens of coliform bacteria. *J. Immunol.* 47: 59-66, July 1943.



PENICILLIN IN SYCOSIS BARBAE

Crusts, if present, were removed before penicillin was applied, and shaving was discouraged, especially in the early stages of treatment. Penicillin was usually applied as an ointment containing 400 units of calcium or sodium penicillin per gramme of base, the latter being a mixture of equal parts of lanette wax S. X., petroleum jelly, and water. In a few cases solutions of penicillin were used.

Analysis of results of the 15 cases treated showed that 8 cases were considered cured but only after two or more periods of treatment, 5 failed to heal after relapse, 1 never showed any change in the progress of the disease and 1 is still under treatment.

The tendency of cases of sycosis barbae to relapse after apparent cure is well known, and there is no reason to suppose that penicillin can abolish this inherent tendency. The most to be expected of penicillin is that it may cure established infection or, if applied prophylactically, prevent reinfection. Established infection was indeed cured, though sometimes only temporarily, in all but one of this series.—ROXBURGH, I. A.; CHRISTIE, R. V.; and ROXBURGH, A. C.: Penicillin in treatment of certain diseases of skin. *Brit. M. J.* 1: 524-528, April 15, 1944.

FILARIASIS

CLINICAL FINDINGS IN 189 CASES

PAUL A. G. JOHNSON
Commander (MC) U.S.N.R.

The series presented in this statistical study consists of cases occurring in Marines, the majority of whom had been examined by the Filariasis Board in the South Pacific and returned to the Marine Corps Base in San Diego. The members of this board have published a report of a similar group observed in the Samoan area¹. A lesser number of men were evacuated from defense areas because of such diseases as malaria, bronchitis, and otitis media, and developed symptoms of filariasis after reaching this base.

The purpose of this report is to offer some additional information regarding physical signs and effects of exercise upon the patients, and thus possibly to give a working basis for prognosis. The observations are summarized briefly in table 1. Series A includes 100 cases seen in July and August of 1943; series B 89 cases seen in September, October, and November 1943.

The number of cases seen from Wallis Island as compared with those from Samoa is not significant. Huntington and Schutz² state that the per capita ratio is greater in the former location where 80 percent of the native population is found to be infected.

By incubation period, as used here, is meant the time between arrival in an infested area and the development of symptoms. The mean incubation period was 9½ months, but the dispersion was considerable. The Filariasis Board reported the removal of a living nematode from a Marine who had lived in Samoa no more than 5½ months. Six of the Marines in this San Diego group had been stationed in Samoa 5 months or less before they developed symptoms. One had been living in the area only 3 months before symptoms appeared. On the other hand, 14 patients had been in Samoa 15 months or more, one as long as 22 months before the disease became apparent. The average stay in the endemic area before signs of filariasis were noted was 9.73 months in series A and 9.83 months in series B.

¹ DICKSON, J. G.; HUNTINGTON, R. W., JR., and EICHOLD, S.: Filariasis in defense force, Samoan group; preliminary report. U. S. Nav. M. Bull. 41: 1240-1251, September 1943.

² HUNTINGTON, R. W., JR., and SCHUTZ, R. B.: Personal communication.

TABLE 1.—*Summary of observations in 189 cases*

Location	Series A	Series B
	No. of cases	No. of cases
Samoa.....	69	65
Wallis Island.....	19	10
Both places.....	12	14
Total.....	100	89
	<i>Average</i>	<i>Average</i>
Months without symptoms (overseas).....	9.73	9.87
Months with symptoms (overseas).....	2.70	2.78
Days in U. S. N. hospital (within U. S.).....	17.90	25.64
Days on leave.....	36.74	36.47
Symptoms and signs	<i>Percent</i>	<i>Percent</i>
Swelling.....	100	87.64
Tenderness.....	100	87.64
Fatigue.....	36	37.08
Headache.....	29	12.36
Drowsiness.....	25	17.90
Eye symptoms (blurring of vision).....	18	15.73
Chilly sensation.....	7	10.11
Fever.....	7	
Dysuria.....	2	7.86
Backache.....		20.24
Site of involvement		
Scrotal lesions.....	97	88.70
Arms.....	49	66.30
Legs.....	13	31.40
Increase in symptoms following:		
Exertion.....	100	88.76
Warm weather.....	60	52.80

The number of days within the United States as hospital patients varies only a trifle in the two groups. It would not be in order to attach any significance to the difference in the two series.

SIGNS AND SYMPTOMS

Filariasis usually is thought of as a gross elephantiasis. This conception owes its origin to the descriptions of advanced cases found in textbooks of tropical medicine. That, however, is not the clinical picture seen in servicemen returning from infested areas, for these represent early stages of the disease.

Filariasis as seen here presents the following symptoms: Fatigue, headache, drowsiness, blurring of vision, dysuria, a chilly sensation at times, and backache. There is wide variation in symptoms when comparing one individual with another; however two findings are consistently observed: First, swelling of the affected part, and second, tenderness of the involved area, especially during recrudescence.

The lymphangitis was usually of a descending type, rather than the classical ascending type of lymphatic infection. Lymphadenitis, however, was not always centrifugal, for axillary nodes

were sometimes found when epitrochlears were not palpable. As a rule epitrochlears attract attention because only a minimal amount of enlargement is necessary to make them obviously abnormal.

In quiescent cases the forearm is often found to be slightly indurated in the upper third and continuous with the cubital fossa just to the ulnar side of the midline. Any part of the forearm or upper arm may be involved. Involved glands in the wrist and in the neck were not uncommon. The legs showed less involvement and it was difficult to draw any conclusions from observations of the lower extremities. However patients with lesions elsewhere complained of pain in the popliteal region and in the thigh on the medial aspect without any palpable glandular enlargement. Occasionally there was slight swelling of the ankles without other signs of lymphangitis.

The scrotal lesions presented considerable variation. The testis and epididymis were as a rule but slightly enlarged and somewhat abnormal on palpation. The increased fluid in the tunica could be seen readily during exacerbations. Large inguinal glands were a common finding. Table 1 indicates that these Marines were not kept long in an endemic area after the original attacks. One would not therefore expect to find large hydroceles, although many cases exhibited small accumulations of fluid, usually resulting in a swelling no greater than a large orange. During intervals between attacks the most consistent indication of having had filariasis was a thickening of the spermatic cord that could be detected for several months.

It should be emphasized that even in cases of pronounced swelling, there was a moderate degree of pain, rather than the intense pain anticipated with similar degrees of lymphangitis of any other type. The febrile reaction was mild or absent. Any other lymphangitis of equal severity would probably have produced a fever of 102° to 103°F. There was seldom any fever accompanying acute attacks here. Furthermore all 7 patients in the first group who had fever had intercurrent disease.

SITE OF INVOLVEMENT

The report of the Filariasis Board makes clear the reason for the predominance of scrotal lesions observed here as compared with those in Samoa. It is explained that individuals having one relapse of a scrotal lesion were evacuated from the islands on the first available transport. The San Diego groups showed scrotal lesions in 97 percent of cases in series A and 88 percent in series

B, as compared with 73.3 percent in the Pacific area. Another reason for the prevalence of scrotal lesions there as well as here is the fact that many Marines presenting lesser lesions of the arms do not desire hospitalization and often do not report to the sickbay.

It is almost universally agreed that exercise produces an increase in pain and swelling. The effect of climatic variables, however, is uncertain. Damp weather and genuinely hot weather apparently tend to promote relapses. The time of year in which these cases were studied, July and August in series A and September, October and November in series B may be of importance.

PROGNOSIS

The outlook for patients presenting symptoms of filariasis when transferred from an endemic area to a noninfected area has not, so far as can be learned, been discussed in any textbooks. This lack of information made it impossible to give the Marines examined an idea of what improvement could be expected in the course of their illness. The data presented here were originally accumulated solely for the purpose of prognosis.

It can be readily observed in table 2 that improvement occurred in direct ratio to the time spent within the United States. The patients in the two groups showed a marked improvement after being within the United States more than 107 days. The following is a résumé of the findings:

TABLE 2.—*Tentative prognosis*

SERIES A			
	Percentage	Average days in U. S. A.	Maximum days in U. S. A.
Increase in symptoms.....	12	68	95
No improvement.....	64	71	99
Improved.....	24	106	218
SERIES B			
Increase in symptoms.....	6.74	75.7	113
No improvement.....	37.00	99.2	224
Improved.....	49.55	107.2	247

MANAGEMENT

It was clear on examination of the patients that the men who had had the most attention, namely, a well regulated period of rest in the hospital and above all, an explanation of their problem,

were willing to attempt a return to duty. Of the first 100 who did not receive any special attention early in the course of the disease, 95 requested return to the hospital; 5 chose to remain on duty.

The 89 patients in the second group reached the base at a time when all medical officers were becoming aware of the patients' physical limitations. Consequently the patients realized an attempt was being made to lighten their duties. Of this group of 89 men, 63 (70 percent) requested return to duty and 26 (30 percent) asked for bed rest.

The only known factor which produced this reversal of attitude of the patients was the different psychologic approach to their problem by medical officers. In a large measure this consisted of showing the patients that they were able to work if given a curtailed schedule, and of assuring them that they might return to the sickbay to be placed in bed at any time an exacerbation was noted. This point cannot be overemphasized.

In February 1944 more than 400 patients having filariasis were sent from a hospital to duty at the Marine Corps Base. These men had been given alternate rest and light duty for periods ranging from 1 month to 10 months. Within 6 weeks 54 men have required modified duty schedules. Only 3 have been returned to the dispensary ward for additional rest. The reason for this small number is believed to be due largely to the cooperation of the officers in charge of the duty assigned the patients. It is also of interest that the 3 patients placed in the dispensary ward had less than 2 months of hospitalization. Time alone will give a more mature idea of their actual prognosis.

SUMMARY

One hundred eighty-nine cases of filariasis have been reviewed with special emphasis upon the following features:

1. The incubation period found in series A was 9.73 months, in series B, 9.87 months.
2. Swelling and tenderness were the two symptoms most consistently found associated with filariasis.
3. Exercise and warm weather appeared to increase the discomfort of the patient.
4. The improvement in each of the groups occurred in direct ratio to the period of time spent within the United States.
5. The proper psychologic approach to patients having filariasis markedly reduced their requests for extended hospitalization.

FILARIAL PROBLEM ON NANUMEA

ROBERT B. VENNER
Lieutenant (MC) U.S.N.

Nanumea atoll is the northernmost of 9 small atolls which together are called the Ellice Islands. These islands are a British Crown Colony lying immediately south of the Gilbert and Marshall Islands. Nanumea was occupied by the Marines on 4 September 1943. In the latter part of August, the native population of some 800 persons was moved from their village on Nanumea to the neighboring island of Lakena, 2½ miles distant. Lakena had formerly been used only for farming, as it was more suitable for gardens, taro pits, and cane brakes.

In order to gain some background of the islands, a group of approximately 40 native adults was assembled on Lakena and questioned concerning the history of their people. *Vae fua* (the swelling of the leg) and *lima fua* (swelling of the arm), the result of chronic filarial infection, were reported as being present from ancient times. *Keatola*, the painful, red lymphangitis occurring repeatedly and preceding chronic elephantiasis was not associated with the latter condition. Many years ago the natives lived on Nanumea and rarely stayed the night in Lakena, as it was forbidden; they came to Lakena in the daytime to work the gardens and returned to Nanumea before nightfall. During the last forty years, however, it has been the custom of the people to stay on Lakena to farm, sometimes for long periods; as many as 200 would live there for perhaps a year.

The village on Nanumea has been noted for its beauty and cleanliness during the past two or three decades. However according to the older men, the village has always been free of mosquitoes, the only mosquitoes being found in the brush. On Lakena there have always been mosquitoes, more at certain times than others. Lakena had no cleared village area and a heavier undergrowth. In the center of the latter island are two fresh water lakes, the larger being used as a community bathing pool and stocked with minnows as a means of control of the mosquito larvae.

It is interesting that the natives do not believe mosquitoes have anything to do with *vae* and *lima fua*. They state the disease

runs in certain families. This last observation is noteworthy in that it gives an indication of the habits of the mosquito vector, which has been proved to spend its life in the immediate vicinity of its breeding place. Thus in a family where the adults were infected, those mosquitoes breeding in the immediate vicinity of the habitation would in turn infect the children, and the natives had therefore drawn the logical conclusion that the disease was inherited.

In making a survey of Nanumea for the present and potential importance of filariasis from the military standpoint, only two factors of such a vector-borne disease were considered. No research could be attempted upon the filarial nematode. Also since the military personnel on the island had spent many months in Samoa, the greatest endemic focus of filariasis in the Pacific, no importance could be attached to symptoms manifested by members of this outfit. Consequently only an attempt to discover a few pertinent facts about the mosquito and the number of natives harboring microfilariae was undertaken.

The mosquito was investigated first, both on Nanumea and Lakena. Specimens of ten adults and larvae were prepared for shipment and subsequent identification by the Force Entomologist. A similar number of specimens were sent to the National Naval Medical Center at Bethesda, Maryland. Simple sucking tubes were constructed from large test tubes, pieces of rubber tubing, and gauze. The captured females were killed with chloroform and stored in other tubes in racks protected from ants. Larvae found were killed and prepared for shipment by immersion first in hot water, then 50-percent alcohol for 1 hour and finally they were stored in 70-percent alcohol. If larvae were found which appeared different in any way, a few were allowed to hatch and the adults were examined for gross characteristics.

The searching party went out four times during the 24-hour period, at dawn, at noon, at dusk and at midnight, staying for 1 hour each time, wearing only shorts, and recording both the number of bites obtained and the adults caught during each period. Various localities were investigated; uncleared brush, semi-cleared areas, the very clean, coral-paved grounds of the native villages now inhabited by Marines and kept policed, the carefully cleared area of the medical company, the areas about shaded tents, in the underground sickbays, and about seepage water wells near the air strip. Whether or not the wind was blowing was also recorded. The exact location (artificial or natural containers) and whether it was fresh or salt, clean or brackish water in which the larvae were found was noted.

This party of volunteers searched the island thoroughly for 2 weeks, six to eight men remaining exposed at the various times and in the various places mentioned for 1 hour at a time, recording the data and inspecting the specimens at the end of each period.

On Lakena the same type of survey was conducted. The areas particularly investigated were the seepage water irrigation of the taro pits, the fresh water lakes, the drinking wells on the island, and the area about the newly constructed native village. The village was built near the beach on the side of the island exposed to the prevailing east-northeasterly wind and kept well cleared of trash and any rain water containers.

The natural reservoir for filariasis was investigated on Lakena by taking a brief medical history of approximately 10 percent of the adult population and making a cursory physical examination of the lymphatic system. By means of an interpreter, questions were asked concerning the individual's residence or habits of working on other islands, and symptoms of *keatola*, *vae*, and *lima fua*. Capillary blood smears were also made and stained for later examination, inasmuch as it had been previously discovered at Samoa that the reported periodicity of the microfilariae in the blood was greatly exaggerated.

After the data acquired during this month's survey had been compiled, two facts, contrary to expectation, were emphasized. First, there was certainly more clinical filariasis among the natives, particularly in the chronic stages, than expected; second, both the Marines on Nanumea and the natives on Lakena were breeding their own mosquitoes. Concerning the infection in the natives, it should be noted that all the natives showing either lymphadenopathy (unaccounted for by superficial lesions with lymphatic drainage to those nodes), thickening and matting of the spermatic funiculus, hydrocele or frank elephantiasis, had spent periods of time in other regions considered endemic for filariasis. It could not be proved that any native had acquired his filariasis on these two particular islands.

One hundred of the following data sheets were typed and the information called for recorded after each hunt for the mosquitoes. The larvae, of course, were searched for during the daylight hours.

DATA TABLE

Date.....	Length of time of search.....	Number of bites.....
Number of men...	Number of adults caught.....	Island and sector.....

- A. Adults.
 - 1. Time:
 - a. Dawn.
 - b. Noon.
 - c. Dusk.
 - d. Night.
 - 2. Locality:
 - a. Fale or tent.
 - b. Shade or sun.
 - c. Underbrush or cleared area.
 - d. Swampy or dry ground.
- B. Larvae.
 - 1. Water in which larvae were caught:
 - a. Fresh or salt.
 - b. Clean or brackish.
 - c. Seepage or rain water.
 - 2. Containers:
 - a. Cocoanut shells.
 - b. Palm fronds.
 - c. Puddles of water.
 - d. Barrels for storage.
 - e. Lyster bags.
 - f. Canvas tanks of distillers.
 - g. Cisterns.
 - h. Seepage wells.
- C. Miscellaneous information:
 - 1. Wind.
 - 2. Weather.

The following conclusions and recommendations were sent to the commanding officer of the Marine organization after completing the survey of all sectors on Nanumea.

Conclusions: 1. Larvae of mosquitoes have been recovered from the following breeding places:

- a. Cocoanut shells.
- b. Tin cans.
- c. Barrels for collecting and storage of rain water.
- d. Sagging gutters in tents and tarpaulins.
- e. Both large concrete cisterns for storage of rain water at the village church.
- f. Cistern on the northeast side of lagoon from which water is pumped for mixing of concrete.

Note.—The greatest single offender was the large cistern at the church, built years ago by the natives, and covered only to prevent falling debris from entering. The breeding places next in offense were the barrels for storage of rain water. Third in order were the cocoanut shells lying in un-cleared areas, or not picked up after removing the meat.

2. Breeding places investigated unsuccessfully to date but suspected of harboring larvae are:

- a. Seepage water wells other than the above.

- b. Pool of standing water near command post.
- c. Canvas storage tanks of the distilling machines not pumped dry at least once a week or completely covered.
- d. Lyster bags not completely emptied and thoroughly cleaned once a week.
- e. Water trailers not completely emptied once a week.

Note.—It has been noted that in the above mentioned artificial containers of water the outlets are above the surface of the water when the container is nearly empty. However larvae remain near the surface and as the container is emptied by releasing water near the bottom, the larvae remain in the barrel or bag undisturbed even though the containers are supposedly emptied and filled many times. The water from the distillers which enters the canvas tank is warm. On Nanumea these tanks were emptied so often because of the water shortage that no larvae were recovered from them. One Lyster bag, unused for some time, was found to harbor larvae.

- 3. Adult vectors have been caught in the following places:
 - a. Tents inhabited by Marine and Naval personnel.
 - b. Fales inhabited by personnel.
 - c. Old uninhabited fale.
 - d. Underbrush near breeding containers.
 - e. Cisterns at the village church.
 - f. Native pao-pao's beached on Nanumea carrying natives from Lakena.
- 4. Effect of wind, light, and period of greatest activity:
 - a. Tents securing adequate through-and-through ventilation are definitely more free of mosquitoes than are those in which there is no breeze.
 - b. The mosquitoes are more active in the hours of partial daylight, just after dawn and just prior to nightfall. However the mosquitoes are active in tents later in the morning and earlier in the evening than they are in exposed areas. No adults have as yet been caught late at night and very few during bright daylight hours, even in the shaded underbrush; none has been caught in the sun.

Note.—In one large tent which housed six of the men helping with the survey, bites would occur occasionally throughout the day. This tent was placed crosswise to the prevailing wind, shaded by palm trees, and the sides were stretched laterally and pegged down as a protection against the driving rains. As a result of its arrangement it was always dark and without adequate ventilation. Even in this tent the mosquitoes more avidly sought a blood meal during a period from about 1330 to 1830. On days on which there was no sun or wind, the bites obtained in the open fale were fewer in number and occurred an hour or so later than bites in the tent. On days on which there was sun and wind, virtually no bites were obtained in the open fale, whereas the number was unappreciably diminished in the tent.

It was also found that any tent or fale having next to it a fresh water container harboring larvae was certainly more infected with mosquitoes than was the adjoining tent or fale using the same water from the former habitation and having no breeding places under its own eaves.

Recommendations: 1. Screen the cisterns at the church with fine mesh screen.

- 2. Face tents into the breeze, securing through-and-through ventilation.
- 3. Cover all rain water containers with target cloth with wooden frames to fit snugly and securely over the top of the containers.

4. Spray tents and fales once daily at 1600 with an insecticide spray.
5. Native pao-pao's coming from Lakena in the morning should be sprayed with insecticide.
6. The wearing of shirts and full-length trousers is very much more indicated after 1600 while sitting in tents or fales than it is while working during the day in the open. Men working in dense underbrush and shade, as about the fighter strip, should be protected during the day by clothing.
7. Mosquito nets are advisable because of the insects' period of greatest activity occurring just after dawn. Many reported instances of night biting by mosquitoes may in reality be insect activity at dawn.
8. As soon as time permits, ridding the entire island of trash and all possible receptacles for water is advisable, as adult vectors may be carried on clothing or in trucks much farther than is their normal range of flight. It has been proved that cleared areas, well policed, are practically free of mosquitoes, and that underbrush where water usually collects harbors mosquitoes in moderate numbers.
9. Screening should be of 14- to 16-gage mesh.
10. Number-2 fuel or diesel oil is a satisfactory larvicide. Waste crankcase oil by itself is unsatisfactory unless it is diluted with kerosene.

The same data sheets were filled out during the survey on Lakena. One great difference in the two islands is in the sources of fresh water. On Nanumea rain water is collected and stored, seepage water from the ground being unpalatable for drinking and unsuitable for laundry purposes, whereas on Lakena, wells are dug to provide water for both drinking and laundry. These wells harbor few larvae, their constant use helping to keep the number of larvae down. The native village on Lakena harbors few rain water containers either in the form of natural or artificial water collectors or trash. Native magistrates enforce the cleaning of areas about the fales as recommended by the native medical practitioner who is responsible for the health and sanitation of the island. The fresh water lake nearest the village and stocked with minnows is free of larvae, but the unstocked lake is a fertile breeding place.

By far the most prolific breeding grounds for larvae are the taro pits. This edible root is grown in excavated areas sometimes as large as 30 feet square. The pre-excavations are made deep enough so that smaller, deeper holes in the floor of the large garden will constantly contain water seeping up from the ground. Rain water will also stand for days in these excavations. Another main difference, between the two islands, is the total number of mosquitoes. The mosquitoes are present in far greater numbers on Lakena, being particularly numerous about the taro gardens. The period of greatest activity in the outskirts of the underbrush and about the lake, as evidenced by the total number of bites and the adult vectors caught, is from 1730 to 1900. However, in the paths through the underbrush sheltered from the

wind and shaded from the sun, the insects are active all day. The men were bitten freely at night although the total number of mosquitoes caught at night was not as great as at dusk.

Two species of *aedes* and one species of *culex* were found on both Lakena and Nanumea. On Nanumea were found very few *culex* mosquitoes. No adults of this genus were caught, but several larvae, identified as *Culex annulirostris*, were obtained from two brackish seepage water wells. Adults of the genus and species *Aedes aegypti* and *Aedes scutellaris* var. *pseudoscutellaris* were found in approximately equal numbers. The larvae of these two species of *aedes* mosquito were found in the rain water of both artificial and natural containers (i.e., barrels, cocoanut shells, hollow tree stumps, etc.). It was therefore only these two species of *aedes*; namely, *aegypti* and *scutellaris* var. *pseudoscutellaris*, which presented any great problem as vectors of filariasis on Nanumea.

However, on Lakena, although the same three species of mosquito were found, their relative numbers were very different. As mentioned previously, the greatest number of larvae were recovered from the taro pits. An unaccountable discrepancy was noted between the species of larvae found in the pits and the species of adults caught both during the day and night in this area. By far the greatest number of larvae were identified as *Culex annulirostris*, although larvae of *Aedes aegypti* and *Aedes scutellaris* var. *pseudoscutellaris* were found in this particular breeding place. In the few containers of rain water about the native village and in the brush only the two species of *aedes* were found. However, adults of the genus *aedes* were caught both in the region of the taro pits and about the fales in the native village, in tremendous preponderance over adults of the genus *culex*.

The following data sheets were filled out on approximately 10 percent of the adult natives on Lakena:

DATA SHEETS

A. History:

1. Name.
2. Birthplace, age.
3. Length of time and dates of working or residence on another island.
4. Have you ever had "vae fua" or "lima fua?"
5. Where on the body?
6. When did you have "vae fua" or "lima fua?"

B. Physical examination:

1. Trochlear nodes..... Enlarged and/or inflamed
2. Axillary nodes..... Enlarged and/or inflamed
3. Breast..... Lymphangitis and/or connective tissue hyperplasia

- | | |
|-------------------------|--------------------------|
| 4. Popliteal nodes..... | Enlarged and/or inflamed |
| 5. Inguinal nodes..... | Enlarged and/or inflamed |
| 6. Spermatic cord..... | Thickened and/or tender |
| 7. Testicles..... | Hydrocele |
| 8. Scrotum..... | Edema |
| 9. Elephantiasis..... | Region of body |

Record presence of yaws or infection which might account for enlargement of nodes by lymphatic drainage.

C. Remarks.

No Giemsa stain was included in the medical supplies, therefore a modified Wright's stain was used which proved fairly satisfactory. Due to errors in staining while the method was being developed, only 65 smears could be accurately examined. Of this total, 33 were found to be positive, 1 doubtful and 31 negative. It was also noted that there was a relatively high eosinophilia. No other abnormalities of the white blood cells were noted. The degree of infestation by microfilariae varied considerably, from 2 to as many as 75 in a single field.

The clinical findings ranged from very mild signs such as inguinal lymphadenopathy, epitrochlear nodes, matting of the spermatic funiculus, and a certain thickening and edematous condition of the skin of the arm above the medial epicondyle of the humerus, to large hydrocele and massive elephantiasis of both upper and lower extremities. One young man, 18 years of age, presented an elephantiasis of both legs, limited at the knees, so that the circumference in the region of the calf was but slightly less than the circumference of an ordinary galvanized bucket. It was a remarkable fact that no correlation could be made between the extent of the clinical findings and the number of microfilariae found in the capillary blood smear. Many adults with no physical evidence of filariasis were proved to be heavily infected with microfilariae. On the other hand, the smears of all adults with frank elephantiasis were positive in varying degrees.

SUMMARY

From the investigation made in connection with the survey, the following facts became evident.

1. In general there are relatively few mosquitoes on Nanumea, whereas Lakena is heavily infested.
2. Only two genera and three species were found, i.e., (a) *Culex annulirostris*, (b) *Aedes scutellaris* var. *pseudoscutellaris*, and (c) *Aedes aegypti*.

3. The chief breeding places for mosquitoes on Nanumea were the cisterns and barrels used to collect and store rain water.

4. The chief breeding places on Lakena were the taro pits.

5. The mosquitoes in the open are most active after 1700 until sunset, and their activity is greatly influenced by the amount of breeze. In sheltered tents and dense underbrush the mosquitoes are active in lesser numbers throughout the day and night. There is a period of activity shortly after dawn, before the sun rises and the breeze starts.

6. Approximately 50 percent of the adult natives show clinical signs of filariasis, or positive blood smears, or both.



TYROTHRICIN

Tyrothricin is beginning to appear on prescriptions for topical use against a variety of gram-positive organisms. It is very effective against gram-positive bacteria and shows only slight action against gram-negative organisms. Its action against gram-positive organisms is due to both gramicidin and tyrocidine, whereas its action on gram-negative organisms is due to its tyrocidine content.

Due to its tyrocidine and gramicidin content, tyrothricin has two actions on bacteria. Tyrocidine is very effective in lowering the surface tension of solutions. Its action on cells results in complete inhibition of metabolic function and disintegration or lysis.

Although gramicidin also has the property of altering surface tension, its bactericidal action is not related solely to this property. Heat will destroy the bactericidal properties of gramicidin but will not affect its power to depress surface tension.

The toxicity of tyrothricin limits its use to localized infections that permit topical application.

It is effective against infections caused by gram-positive bacteria such as streptococci, staphylococci, pneumococci and diphtheria bacilli. It has been used successfully in empyema, osteomyelitis, ophthalmic infections, in ear, nose and throat infections, and in lesions of skin and soft tissue.—SILBERGLEIT, A. H.: Tyrothricin; new antibiotic from soil bacterium now available to combat localized infections. *J. Am. Pharm. A.* 5: 232-234, September 1944.

EYEGASSES FOR COMBAT

ARTHUR ALEXANDER KNAPP

Commander (MC) U.S.N.R.

There is a general opinion that the wearing of eyeglasses in the armed forces should be discouraged, especially in the combat zones. It is also a common belief, even among eye surgeons, that a serviceman with 20/20 vision has no use for spectacles in battle. Both of these conclusions are in need of amplification.

There are many who can readily pass the Navy eye examination, but who nevertheless require glasses to correct their refractive errors. They request lenses because of two basic complaints—comparatively poor vision, or symptoms of asthenopia, or both.

Solely for the purpose of this paper, comparatively poor vision may be interpreted as vision of 20/20 or less. The 20/20 standard is not normal; it has been chosen arbitrarily as the normal. The majority of people considered to have normal eyes actually have a visual acuity superior to 20/20. With accurate correction and optimum conditions, a large percentage of the ametropes in the military forces will read the 20/15 line, an increase of approximately 33 percent over the accepted standard. Indeed some of these men will distinguish the 20/10 letters, an increase of 100 percent.

Bearing this in mind let us consider the vision of the enemy. Unfortunately, the Axis nations also have fighting men whose eyes have an acuity greater than 20/20. Since one cannot select his antagonist, it is well to concede a minimum of 20/20 to the man who potentially controls one's fate. Therefore if our own fighter just reads the 20/20 line or less with the naked eye, yet has sufficient vision to qualify him for the forces, should we advise him not to wear glasses even though his eyesight can thereby be corrected to 20/15? With few exceptions he should be counseled to wear them as much as possible in combat. The man with subnormal eyesight has the best reason for wearing his glasses in the fighting area. With better vision he is far more the match, or even the superior of his foe. Observation of his opponent before the latter recognizes him often will mean the difference between life and death. This applies particularly to the men on patrol. Aboard ship the ability to spot the enemy's plane or ship

seconds earlier may change the whole complexion of the ensuing encounter.

The use of binoculars in no way contraindicates eyeglasses. Telescopic lenses do not correct for astigmatism. Astigmatism, especially of a mild or trivial degree, can be very annoying if the eyes are engaged in concentrated gaze. Glare, too, may aggravate the discomfort. Either, or both of these factors will lower the visual efficiency.

Since many sailors have some astigmatism, it would be well for them to have a careful cycloplegic refraction and their astigmatism precisely corrected for "binocular watch." Any kind of glass will protect in some measure against glare. Instead of having their eyes tire after a few moments, the men with glasses could continue sighting with the binoculars for longer periods and indeed see more accurately. In other types of combat duty, as in air warfare or in the firing of machine or larger guns, more often it will be advantageous to wear spectacles, if the sight can thereby be improved.

Wearing glasses for the relief of symptoms such as headache or eyestrain is also recommended whenever feasible.

Some members of the armed forces are myopic. Without their minus lenses they see poorly. Occasionally, it happens that these myopes misplace, break, or lose their glasses. When this occurs and a second pair is not available, the myope has recourse to "home-made spectacles." A piece of cardboard, or other opaque object, is punctured to make two pin-point openings on a horizontal plane and separated by a distance equivalent to the interpupillary distance of the individual concerned. By placing the openings before each pupil, the man will be surprised to find that his vision is approximately equal to that with glasses.

What are the disadvantages of wearing spectacles in the combat zone? Obviously, there is a great one—the possibility of breakage of the lenses with resultant injury to the eyes or face. Though a representative number of Navy personnel make use of spectacles, only exceptionally does this type of accident occur in combat. Practically any missile sufficiently destructive to shatter an eyeglass and damage the orbit both directly and by the broken glass, would cause almost as extensive an injury to the unaided eye. Hence it is understandable that the advantage of improved vision with glasses far outweighs the disadvantage of the hazard of shattered glass.

There are some situations, however, in which spectacles should not be worn, as in hand to hand conflict. On patrol duty often it is vitally important for the individual not to wear anything

that may reflect light rays. Any reflection, no matter how slight, may mean death at the hands of the enemy. In the tropics spectacles often are an inconvenience because of perspiration and fogging. Also aboard ship when there is a high sea running, with spray, they should be dispensed with.

Sun glasses are to be prescribed primarily for ocular discomfort due to excessive light—symptoms of asthenopia or reduced vision. Excessive light or glare may interfere with visual acuity, the threshold of glare varying widely in otherwise normal individuals.

Spectacles with shatterproof lenses are practical, and cosmetically they have the same appearance as other glasses. These or “semi-shatterproof” lenses can be ground to the patient’s own prescription, either tinted or clear.



SERUM AMYLASE TEST FOR MUMPS

An elevation of serum amylase is present in the great majority of cases of epidemic mumps. It is especially to be expected since the parotid gland which is the chief salivary enzyme producer is frequently affected. The finding is naturally of academic interest and has a sound basis. Although the diagnosis of mumps is usually simple, there are cases which present differential problems. The normal serum amylase helps to rule out contagion and the subsequent course and objective findings confirm the reliability of this test. Elevated levels also assist in establishing a diagnosis of mumps in the early development of doubtful cases. Thus, the test has both a positive and negative value. No explanation can be offered for the normal levels which occur in individuals past the third decade of life. Therefore, a normal level can be found in exceptional instances of epidemic parotitis, perhaps important in older age groups. It also seems reasonable to assume that normal levels are the rule rather than the exception in extra parotid salivary mumps and in cases which are admitted for extension and complications such as orchitis, meningo-encephalitis, etc., after the parotid disease has subsided. Particularly during epidemics the diastase level may assist in establishing or excluding the diagnosis of mumps in an observation case. Cellulitis of the face, infection of the teeth and gums, pre-auricular and cervical lymphadenopathy are among the conditions which may at times create confusion.—APPLEBAUM, I. L.: Serum amylase in mumps. *Ann. Int. Med.* 21: 35-43, July 1944.

EARLY USE OF SOUNDS FOR GONORRHEAL URETHRITIS

FRANCIS A. BENEVENTI
Lieutenant (MC) U.S.N.R.

In an effort to save as many Navy man-hours as possible which are lost because of acute gonorrheal urethritis, the problem was studied by comparing two groups of similar patients with gonorrhea. One group received sulfonamides in addition to local treatment but sounds were not used, whereas the other group received the standard treatment as well as the use of sounds during the acute stage of the illness.

The sulfonamides alone have been effective in a large number of instances, and many patients have been cured of gonorrhea on ambulatory treatment with the drug without loss of time. There are many patients in the tropics, however, who do not respond equally well; consequently other adjuncts to the treatment with sulfonamides are sought to hasten the cure. Many patients have filled the wards who had received the prescribed course of sulfonamides only to find that the urethral discharge recurred several days or weeks after the drug was discontinued. When another course of treatment with the same drug or another sulfonamide was instituted after an adequate rest period, it was found to be of little value. These patients were referred to the hospital for further treatment as the urethral smears were still positive.

In the past it has been felt that patients should receive a prostatic massage with examination of the smear for gonococci and the passage of a number 24F sound just before being discharged from the ward. These sounds were generally used after the patients were free of urethral discharge. There have been patients who had urethral strictures and pockets which harbored the gonococci. Unless these recesses were broken up by the passage of a sound, their presence could not be determined; therefore, a number 24F sound is passed within 1 week following admission to the hospital, so that if the entire length of the urethra did not provide adequate drainage, such conditions could be discovered and remedied.

COMPARATIVE STUDY OF TREATMENT

Of the first 40 patients to enter with acute gonorrheal urethritis during a set period, some had had previous treatment for as long a period of time as 4 months, whereas others represented fresh cases. These were divided into two groups of 20 each. One group received one or more courses of sulfathiazole, sulfadiazine, or both and also local urethral injections, prostatic massage, posterior instillations, and a sound after all urethral signs had disappeared and the patient was about to be discharged. The second group received all this with the exception that the urethra was sounded in the presence of a urethral discharge while the patient was taking sulfonamide therapy and had had at least 15 gm. of the drug.

The passage of a sound in acute gonorrheal infections with moderate urethral discharges does not cause an extension of the infection back into the posterior urethra provided the patient is receiving sulfonamide medication. We have seen no complications, such as posterior urethritis, prostatitis, or epididymitis following this procedure.

TABLE 1.—*Comparative study of treatment*

Group I <i>No sounds</i>					Group II <i>Sounds used</i>			
No.	Name	Previous OPD days of treatment	Hospital days of treatment	Other pertinent findings and procedure	Name	Previous OPD days of treatment	Hospital days of treatment	Other pertinent findings and procedure
1	L	55	10		T	35	29	
2	D	39	19		B	12	36	
3	R	29	33		M	11	51	
4	H	20	16		S	8	53	
5	G	59	11		MC	2	54	
6	C	0	25		D	19	61	
7	P	20	32		K	0	8	
8	W	13	71		L	0	10	
9	S	24	55		M	60	11	Meatotomy
10	J	62	5		P	76	14	"
11	C	16	14		MC	41	9	
12	W	128	31		W	0	12	
13	S	0	24		A	61	17	"
14	R	33	24		A	4	12	
15	E	13	40		C	43	12	
16	L	10	48		C	130	7	Strictures.
17	O'C	7	57		G	11	16	
18	N	43	38		S	21	11	
19	MC	40	24		M	7	20	
20	D	0	15		S	11	19	
Average days:		30.5	29.5			30	22	

ANALYSIS OF FINDINGS

The accompanying table shows the comparison of the two groups studied, and gives the number of days of treatment before entering the hospital, the number of days in the hospital, and the

type of treatment. For purposes of comparison, we were fortunate in having two such similar groups of patients who had had treatment for an almost equal number of days prior to admission. The average for each of the groups was 30 days. Cases 9, 10 and 13 in group II required meatotomy in order to permit the passage of a number 24F sound. This size was considered suitable for adequate drainage. As seen on the accompanying chart, each of these three cases with small meatuses responded well following meatotomy.

One patient (case 16, group II) was found to have dense urethral strictures as a result of gonorrheal urethritis 7 years previously. This patient had taken sulfonamide treatment for 130 days prior to hospital admission. He was sounded on the day following admission and found to have a 16F caliber urethral stricture. Filiform guides with Le Fort follow-up sounds were used to dilate the urethra to size 24F within 7 days, and the patient responded well. The urethral discharge ceased after the first urethral dilatation.

There were three patients in each group who had fresh urethral discharges and entered the hospital as soon as the urethral discharge made its appearance.

The average hospital stay for these 3 patients in group I (those receiving no sounds until after the urethral discharge stopped) was 21 days, whereas the hospital stay for the similar 3 patients in group II was 10 days. The average number of hospital days saved in 20 patients in group II was 7 days, making a total of 140 Navy man-days saved.



DIFFUSIBILITY OF PENICILLIN

While penicillin diffuses fairly readily into most tissues, it does not reach the spinal fluid following intravenous or intramuscular injection. It is necessary, therefore, to administer penicillin by the intrathecal route at least once daily in treatment of infections involving the cerebrospinal structures. Following intravenous administration of penicillin, antibacterial amounts of the material reach the fluid of septic joints. Likewise, penicillin is transmitted through the placenta from the mother to the fetus. This is important in penicillin therapy for antepartum syphilis.—HERRELL, W. E.; NICHOLS, D. R.; and HEILMAN, D. H.: Penicillin; its usefulness, limitations, diffusion and detection, with analysis of 150 cases in which it was employed. *J.A.M.A.* 125: 1003-1011, August 12, 1944.

MEDICAL ILLUSTRATION

JOHN T. STRINGER, JR.
Lieutenant, junior grade H-V(S) U.S.N.R.

Art, photography, and moulage, including moulage prosthesis, are the mediums of medical illustration. Through these procedures it is possible to illustrate any given case or procedure.

Medical illustration units should be stationed in all the major Naval base hospitals, hospital ships, and in the various theaters of operation.

There are many former commercial artists and photographers assigned to the Hospital Corps as enlisted men, as there are others with ability in modeling, sculpturing, and cosmetics. These men may be trained, and with little difficulty turned into first-class moulage and prosthetic technicians.

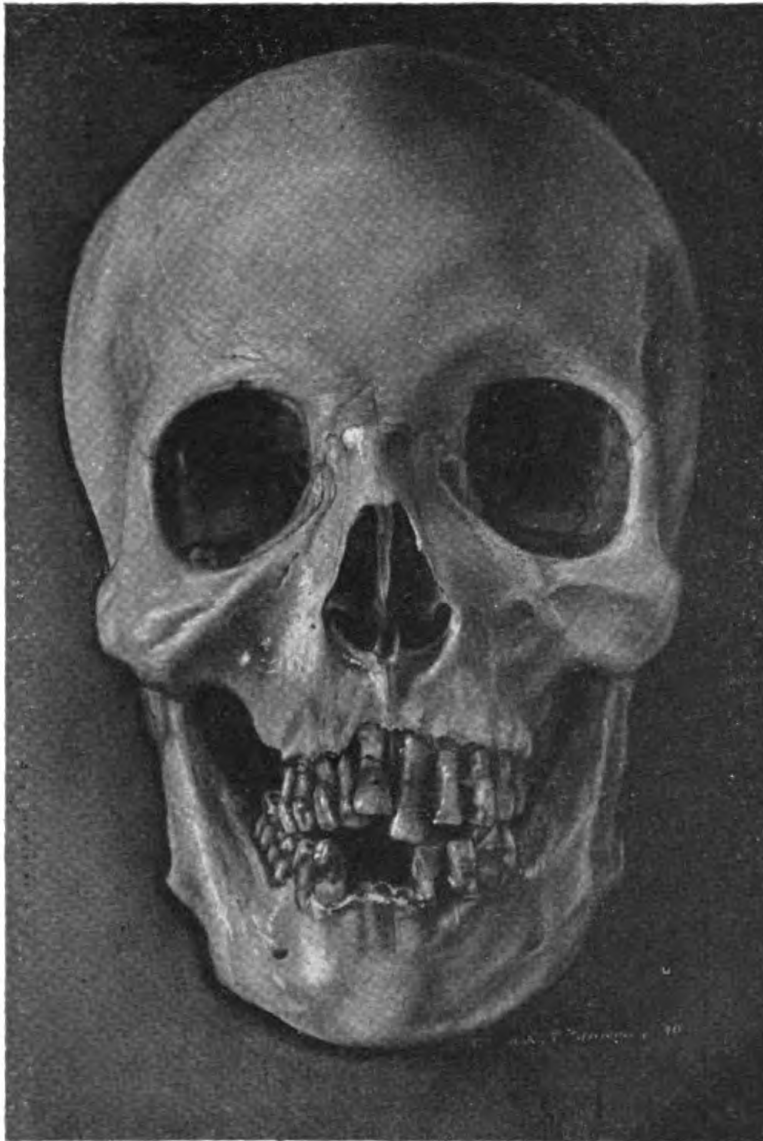
The duty of the medical illustration unit is to record by photography, cinematography, drawings, paintings, and moulage the wounds, injuries, and diseases relating to warfare, and their treatment. The field units are mobile and should be transferred to the locations where they may be of most value.

Photography is the medium most frequently used. It is the easiest and the cheapest method of medical illustration and is available to all who have access to cameras. A photograph, however, is not always satisfactory. Sometimes a good drawing is of more value. Moulage and moulage prosthesis are excellent mediums of representation but they are not so available and practical. They are three dimensional, however, and true colors may be effectively and permanently reproduced.

It is imperative that medical and dental officers understand these mediums and the various types of illustrations that can be produced from each. They should cooperate in planning and determining the medium which is most suitable for the case that is to be presented, this decision depending on the subject and on the purpose for which the illustration is to be used.

Medical art.—Medical art comprises the various types of drawings and paintings that are produced to illustrate medical and surgical cases and procedures. Figure 1 is an example of pencil-dust technic.

Colored drawing or painting is handicapped by the costly reproduction processes.



1. Example of medical art. This skull was drawn in pencil-dust technic. Note detail.

Photography.—Photography is practiced in both black and white and in color. Still and motion pictures are made of clinical and surgical cases and procedures, pathologic specimens and sections, and organisms as seen through the microscope. Photographic copies are made of roentgenograms, charts, drawings, and medical and scientific publications. Figure 2 is an example of black and white medical still photography.

Moulage.—The word “moulage” is of French origin, from the word *mouler*, to cast or to mold,¹ In science it means a finished cast. Moulages are made of wax composition, rubber, celluloid,

¹ CLARKE, C. D.: Molding and Casting. John D. Lucas, Baltimore.



2. Example of medical photography. Gunshot wound of forearm.

gelatin, plastic, clay, glue, or plaster. The models are easily colored. Preoperative and postoperative conditions of unusual interest are made into models for comparison and study.

The steps of an operation can be clearly shown by a series of lifelike casts. Pathologic specimens are reproduced and remain lifelike in color as well as in texture and size.

Figure 3 is an example of a moulage. It is a cast of the hand showing tubercular lesions.

Moulage offers advantages but has an equal number of disadvantages. Most moulages are fragile and bulky and difficulty is encountered in storing and transporting, whereas drawings and photographs are easily made, stored, transferred, and shipped.

Moulage prosthesis.—A moulage prosthesis is made for the injured to wear during his convalescent period; that is, between



3. Example of moulage. Wax cast of hand, illustrating tubercular lesions.

plastic operations in indicated cases. A relatively permanent prosthesis (from time to time a new one must be made) is made for the mutilated who receive little benefit from plastic surgery, or who are poor operative risks.

The patient must be educated and accustomed to the artificial portion. He must be taught to apply it carefully and to make up accurately with cosmetics to disguise the missing or disfigured portion. The edges of the prosthesis must also be concealed.

During wartime, the art and science of prosthesis becomes a practical necessity. Until a material or substance is found or perfected which will remain lifelike as well as durable, any prosthesis will be artificial in appearance.

PENICILLIN IN THE TREATMENT OF PRIMARY ATYPICAL PNEUMONIA

REPORT OF NINE CASES

JAMES J. SHORT
Commander (MC) U.S.N.R.

The favorable results obtained from the use of penicillin in a wide variety of conditions led to the attempt to test its effect in an uncomplicated case of primary atypical pneumonia. Since this type of pneumonia is generally conceded to be of virus origin, it was not expected to be of value. The sulfonamides are generally acknowledged to be useless in virus pneumonia except as a possible prophylactic against secondary bacterial invaders. Treatment has generally been expectant and supportive and patients usually recover without sequelae. Febrile reactions in uncomplicated cases vary considerably but may run an irregular course with frequent high levels for one to three weeks or longer.

In the first case of this series treated with penicillin the patient responded with a sudden and sharp temperature decline, disappearance of symptoms, and rapid convalescence. Since that initial experience eight additional cases have been treated, all of which responded more or less promptly to the drug. A control series was not observed, but results with penicillin seemed to be much superior to those with the expectant, symptomatic treatment formerly used. The disease is relatively infrequent in the South Pacific area which precludes the possibility of obtaining a large series of cases here in the near future. This report is offered as a suggestion to others who have the opportunity of seeing many such cases to try an extensive controlled study of penicillin in primary atypical pneumonia. A résumé of the cases seen here follows.

CASE REPORTS

Case 1.—An Army officer, aged 29, was admitted to this hospital on 19 February 1944 with a diagnosis of primary atypical pneumonia. Symptoms had begun 4 days earlier and consisted of headache, weakness, fever, and cough. On admission the temperature was 103° F., pulse rate 88, and respirations 18, but otherwise there were no significant findings. The first x-ray, made 2 days after admission, showed evidence of slight thickening of the hilar glands on the right side but no parenchymal changes.

Treatment from 20 February to 2 March consisted of sulfadiazine in adequate dosage. There was apparent early improvement, but on 28 February

the temperature rose to new high levels. A second x-ray made at this time showed a large clouded area in the lower right lung field characteristic of a virus pneumonia.

From 3 March through 5 March, 200,000 units of penicillin were administered intramuscularly in doses of 10,000 units every 3 hours. The temperature became normal in 48 hours and remained normal thereafter. An x-ray of the chest showed the lungs to be clearing on 11 March and completely clear one week later. All symptoms disappeared promptly.

Case 2.—A seaman, first class, aged 28, was admitted to this hospital on 1 March 1944 with a diagnosis of primary atypical pneumonia. The onset had been sudden on the previous day with headache, chills, and generalized pains in the extremities. The patient's temperature on admission was 103° F. Physical examination showed suppressed breath sounds at the base of the right lung but no other significant findings. An x-ray taken on the third day showed diffuse clouding of the lower right lung field extending to the periphery. Cough developed on the fifth day of illness.

Sulfadiazine was given for 3 days in doses of gm. every 4 hours. There was no response to this therapy. The temperature fluctuated, with spikes as high as 103.4° F., and there was evidence of toxemia. On 6 March treatment with penicillin, in doses of 10,000 units every 3 hours intramuscularly, was instituted and on 12 March was discontinued, the total dosage being 400,000 units. Twenty-four hours after penicillin therapy was begun there was a notable improvement in the patient's condition. The temperature dropped from 102.8° to 99° F., and after 3 days of therapy remained normal. Recovery was rapid and uneventful.

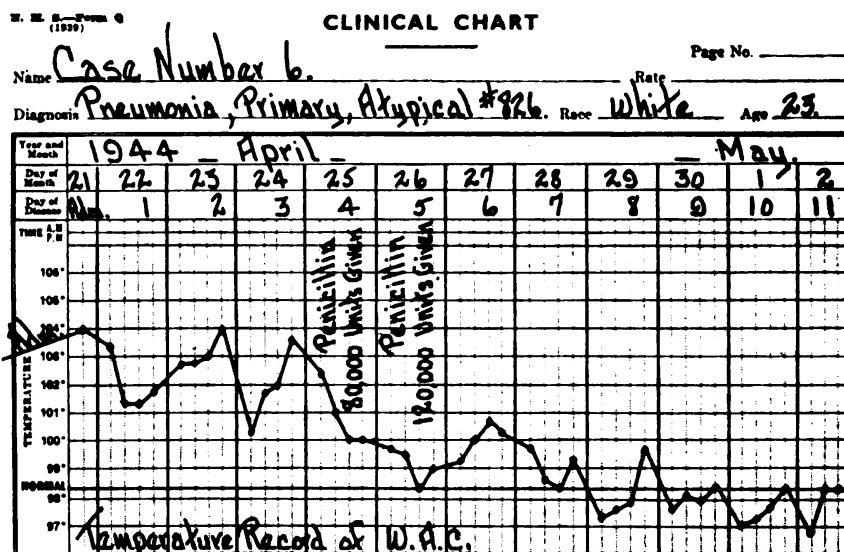
Case 3.—An Army officer, aged 35, was admitted to the hospital on 1 March 1944 with a diagnosis of primary atypical pneumonia, which had had its onset on the previous day with fever and cough.

Examination of the chest did not disclose any abnormality, but a chest x-ray revealed a clouded area in the left lower lung field described as evidence of "apparently a diffuse pneumonitis."

Sulfadiazine, 1 gm. every 4 hours, was administered for 2 days with no response. On 4 March penicillin therapy was instituted in doses of 10,000 units every 3 hours intramuscularly with a total dosage of 180,000 units. On 6 March the temperature dropped from an average of 102° to 100° F. On 7 March it declined to 99° F. and thereafter remained normal. X-ray examination one week later showed almost complete clearing of the pneumonic process. Recovery was steady and uneventful.

Case 4.—A seaman, second class, aged 20, had cough, pain in the chest and fever up to 103° F. for which he had been treated with sulfathiazole for one week prior to admission. He was admitted to the hospital on 14 March 1944 with a diagnosis of primary atypical pneumonia. Physical examination showed diminished breath sounds, fine râles and decreased tactile fremitus over the lower third of the left side of the chest. An x-ray showed marked diffuse central clouding of the left lung suggestive of atypical pneumonia.

The day after admission penicillin therapy was instituted in the dosage of 10,000 units every 3 hours intramuscularly for a total of 200,000 units. The patient became afebrile on the second day, and symptom-free on the third day after penicillin therapy was begun. An x-ray taken 6 days after admission showed marked clearing of the clouded area of the left side of the chest.



Case 5.—A dental officer, aged 31, was admitted with a diagnosis of atypical pneumonia complicated by concurrent benign tertian malaria so that the febrile reaction was without significance as to the course of the pneumonia. Physical examination showed râles and diminished breath sounds at the bases of both lungs and the patient had a severe cough. An x-ray taken 8 days later showed a mottling of both lung fields, in the central areas and extending peripherally, which was suggestive of pneumonitis. The sputum contained mixed organisms of no significance.

The patient was treated for malaria and simultaneously with sulfadiazine. Because there was no improvement in the pulmonary condition, penicillin therapy was begun on the eighth day in the dosage of 10,000 units every 3 hours intramuscularly for a total of 190,000 units. There was prompt improvement in the lung condition and the temperature remained normal after the eleventh day.

Case 6.—An Army private, aged 22, was admitted on 21 April with a diagnosis of primary atypical pneumonia of the lower lobe of the right lung, which had had its onset on the same day with chills, generalized aching pains, and cough with blood-tinged sputum. The patient's temperature was 104° F., pulse rate 80, respirations 22, and blood pressure 114/66. There was very slight cyanosis and there were no pulmonary findings. The spleen was palpable.

The first chest x-ray taken on 24 April showed negative findings; the second taken on the following day showed diffuse clouding of the lower right lung field, confirming the clinical diagnosis.

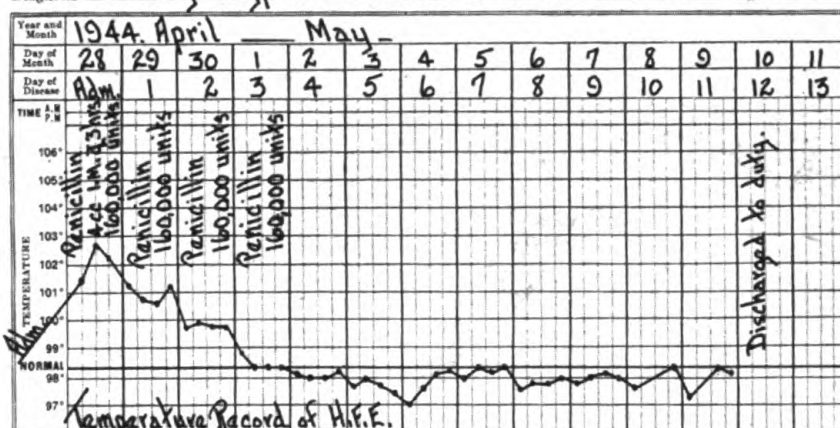
The temperature ranged from 101° to 103° F. until 25 April, when penicillin in doses of 20,000 units every 3 hours intramuscularly was started. Ten doses only were given, with a total of 200,000 units. On 29 April there was an abrupt termination of the fever with amelioration of the cough and other subjective symptoms. On 8 May the chest was clear by x-ray examination, recovery having been prompt and complete.

Case 7.—A medical officer, aged 40, was admitted on 28 April 1944 with a diagnosis of primary atypical pneumonia. Onset 3 days previously had consisted in malaise and generalized aching. On the following 2 days the tem-

N. M. S.—Form 6
(1939)

CLINICAL CHART

Name Case Number 7. Page No. _____
 Rate _____
 Diagnosis Primary Atypical Pneumonia #826 Race White Age 40.



perature rose to 101° F., slight upper respiratory symptoms appeared, and there were generalized pains in the muscles and head. A chest x-ray on 28 April showed clouding of the lower left lung field suggesting acute pneumonitis, but physical signs were minimal. The temperature was 102.8° F. Other findings were without significance.

Sulfadiazine had been given prior to admission in a total of 10 gm. without response. On 28 April penicillin, 20,000 units every 3 hours intramuscularly, was given for 31 doses over a period of 4 days, a total of 620,000 units. There was a prompt, almost dramatic, response to this therapy. The temperature reached normal after 82 hours and remained normal thereafter. On 5 May x-ray examination showed that the clouded area in the lower left lung field had cleared, and there was a coincident disappearance of subjective symptoms except for moderate weakness which persisted for several days.

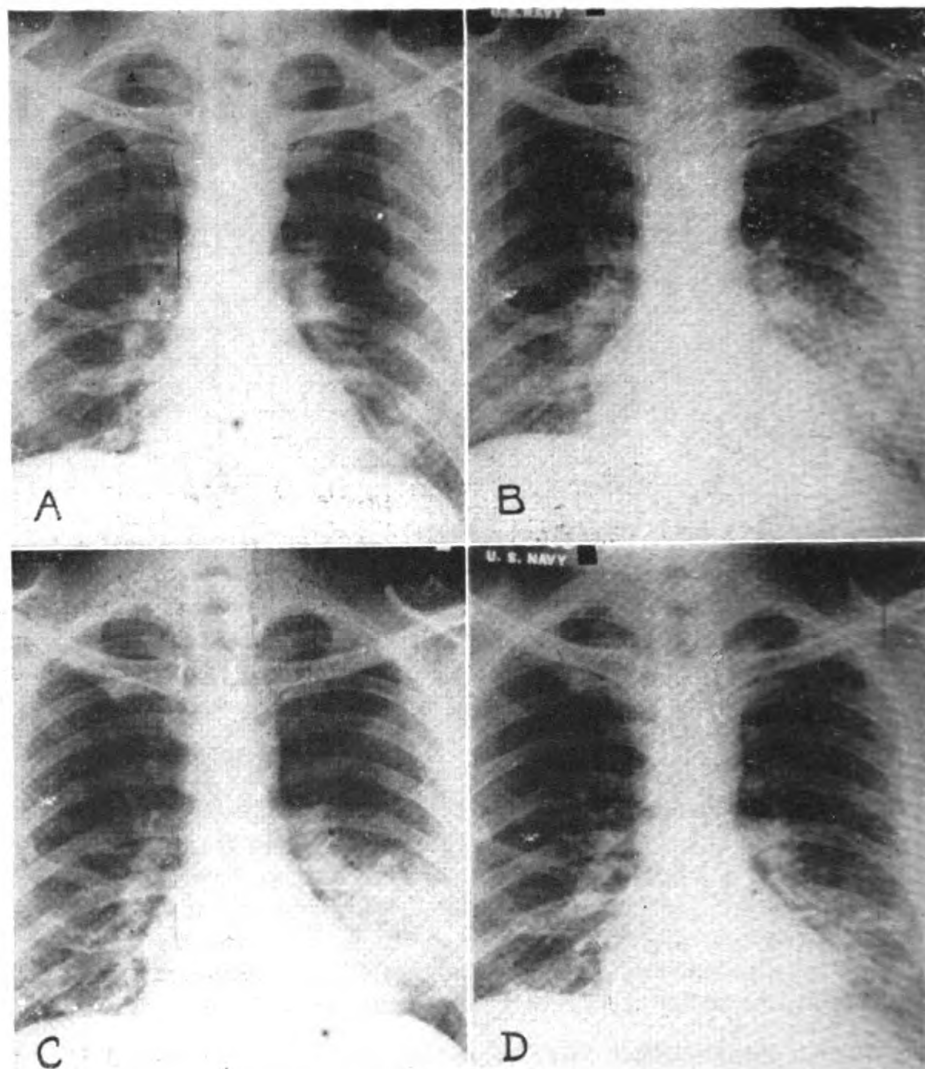
Case 8.—An Army private, first class, aged 21, was admitted 3 May 1944 with a diagnosis of primary atypical pneumonia, which had had its onset 2 days prior to admission with weakness, pain in the upper right side of the chest, chills, and cough, with expectoration of blood-tinged sputum.

Examination showed a temperature of 103.6° F., pulse rate 122, respirations 24, blood pressure 122/76, moderate cyanosis, and slight impairment of resonance of the upper lobe of the right lung, with suppression of breath sounds but no râles.

There was a leukocytosis of 21,600, but the examination of the sputum did not reveal any significant organisms. An x-ray of the chest showed a diffuse clouding of the upper right lung field suggesting an early pneumonic process of the virus type.

Penicillin therapy was begun immediately after admission, 20,000 units being administered intramuscularly every 3 hours for 3 days, making a total of 460,000 units. The temperature responded immediately and reached normal in 42 hours. There was a secondary rise to 101° F. on the third and fourth days, and a level of 99° F. on the fifth and sixth days after which it remained normal.

An x-ray taken 3 days after admission showed distinct clearing of the lung field and recovery thereafter was uneventful.

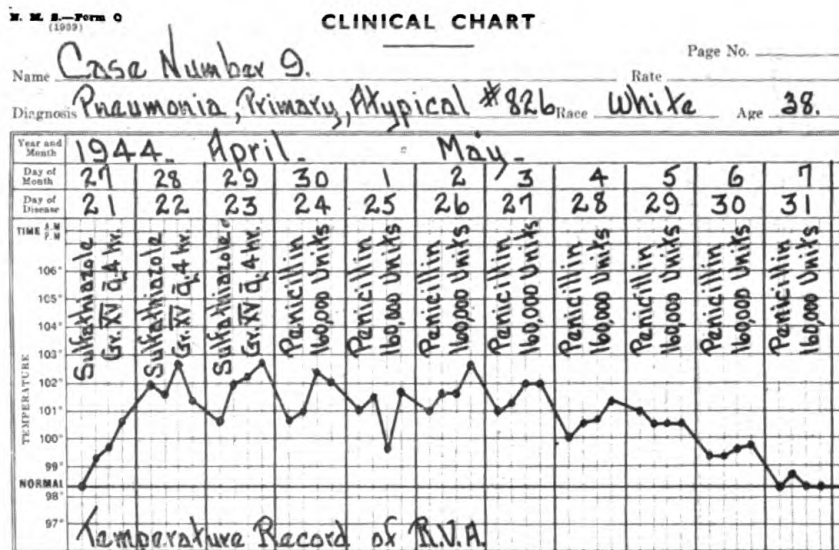


A. Early pneumonic process in the left lower lung field, 28 April 1944. **B.** Increasing density, 2 May. **C.** Extension to maximum noted, 8 May. **D.** Partial resolution, 15 May.

It was thought that penicillin, begun in an early stage in this case, exerted a prompt, maximum effect.

Case 9.—An Army officer, aged 39, was admitted on 6 April 1944 with a diagnosis of acne, severe, generalized, with onset when he was 15 years of age. Physical examination revealed severe scarring over the face, neck, and trunk, and deep-seated abscesses over the trunk. These were treated surgically and with sulfonamides and penicillin with improvement.

On the twenty-first hospital day there was a sharp rise in the temperature to 103° F. with symptoms of an acute respiratory infection. The x-ray showed a clouded area in the lower left lung field, and a diagnosis of primary atypical pneumonia was established. Sulfathiazole was administered for 3 days without noticeable effect and discontinued on the fourth day, when penicillin therapy was instituted in dosage of 20,000 units every 3 hours intramuscularly. The temperature dropped to 99.8° F. in 24 hours but rose



again to 102.8° F. on the following day, from which level it gradually subsided to become normal on the seventh day of penicillin therapy without further elevations.

X-ray examination at the end of the febrile period revealed an even denser clouding of the lower left lung field with some spreading to the right lung. One week later marked clearing was noted in all affected areas and the patient was asymptomatic. Penicillin was discontinued after 8 days of therapy, a total dosage of 1,280,000 units.

Judging from the x-ray evidence this was the most extensively involved case treated, yet the temperature elevation continued for only 6 days after penicillin therapy was instituted. It is interesting that the most extensive involvement was found at the termination of the febrile period. It is conjectured that without the advantage of penicillin therapy this case would have had a very protracted course.

COMMENT

In this small series of 9 cases the average number of days from the institution of penicillin therapy until the temperature became entirely normal and remained so was 3.5. This is decidedly less than the usual expectancy with the former supportive treatment. Although the series is small, the results were definite and striking.

Since these clinical observations were made, a report¹ has been received from the Mayo Clinic of experimental observations on mice inoculated with a highly virulent ornithosis virus of pigeon origin. Several experiments were carried out on small numbers of animals which seemed to indicate a high degree of protection for penicillin. A final tabulation of the results showed that of

¹ HEILMAN, F. R., and HERRELL, W. E.: Penicillin in treatment of experimental ornithosis. Proc. Staff Meet., Mayo Clin. 19: 57-65, February 9, 1944.

40 mice inoculated with virus but untreated, 35 died, a mortality of 88 percent; whereas of 40 mice similarly inoculated but treated with penicillin, 2 died, a mortality of only 5 percent. Since the ornithosis virus is generally considered to be similar to, if not identical with the virus causing primary atypical pneumonia in man, the possibilities are obvious.



ALLERGIC FACTOR IN ALTITUDE SICKNESS

From the records of a random sample from private practice of 500 individuals in Mexico City, fifteen years of age and under, about 50 per cent were found to be frankly allergic. Of the five hundred, 167 had either severe hives, urticarial rashes or eczema, and one hundred had gastrointestinal symptoms directly related to the ingestion of certain foods. Evidence indicates that these symptoms are either milder or do not occur at all in these same individuals at lower altitudes. In those coming to Mexico City, a period of about three weeks is usually required in the older children for the effect to accumulate and become manifest in symptoms. It is suggested that anoxia occurring at this altitude may result in a greater permeability of the gastrointestinal tract to offending substances. In view of the similarity in many of the cases to conditions found in mountain sickness, the possibility is suggested that similar factors may be contributing causes in such conditions, and may be of interest in aviation medicine.

Recommendations: Children with allergic reactions to foods do well at this altitude if the following precautions are taken: (1) avoiding overloading on any one food, (2) not giving any one food more than once or twice a week, (3) avoiding eggs, chocolate, and too much cow's milk, wheat and orange juice, and (4) supplementing the diet with vitamins A, D, B complex, C and calcium. If certain foods cause serious trouble, they must be temporarily omitted from the diet. Thus it is concluded that aviators who have symptoms similar to those described or others that cannot be explained except on an allergic basis would do well to take these precautions.—BAKER, J.: Note on possible allergic factor in altitude sickness. *J. Lab. & Clin. Med.* 29: 831-839, August 1944.

PENICILLIN THERAPY IN PHAGEDENIC ULCER (TROPICAL SLOUGHING PHAGEDENA)

REPORT OF EIGHTEEN CASES

WILLIAM G. HAMM
Commander (MC) U.S.N.R.

and

G. OUARY

Medecin Commandant des Troupes Coloniales Francaises

Phagedenic ulcer is extremely common in most tropical countries, causing an immense amount of disability and frequently leading to emergency amputations to save life. In many localities these ulcers and their complications (toxemia, sepsis, and exhaustion) rank second only to malaria as a principal cause of death.

The cause of phagedenic ulceration is not yet entirely clear, although spirochetes and fusiform bacilli are almost invariably present during the active stage of the lesion, frequently in almost pure culture. Since the feet and legs are the most exposed to injury, they are the most likely locations of the ulceration, although any part of the body may be infected, and the lesion may begin without any evident abrasion or trauma to the skin.

The appearance of a phagedenic ulcer is rather typical, and, as a rule, it is easy to differentiate from other types of skin ulcer. It begins as a small pimple which may be preceded by a break in the skin and usually is accompanied by pain and constitutional symptoms. The latter are doubtless due in large part to secondary infection which is always present to some degree. The ulceration extends rapidly in all directions; the skin borders are raised and often undermined as much as 1 or 2 cm. The ulcer bed is covered with an adherent false membrane composed of necrotic or gangrenous tissue which, when removed, shows areas of gray granulation tissue. In many instances, the sloughing is deep, involving fascia, muscles, blood vessels, and even periosteum. There is a profuse fetid discharge and secondary infection.

Various methods of treatment have been used, but on the whole treatment has not been very satisfactory. Neoarsphenamine, locally and by injection, bismuth compounds, potassium permanganate, acriflavine, vaccinothrapy, sodium iodide combined with hydrogen peroxide, antimony, copper sulfate in glycerin, and sulfanilamide are mentioned as having been used in some instances

with varying degree of success. However, there is no standardized therapy, and considerable disagreement exists as to the best method of treatment.

It was our original plan to use penicillin intramuscularly for these cases, but after a few injections we found that this method was impractical. Our patients were all natives, very superstitious, and had quite an antipathy to the injection needle. They complained bitterly of the pain and the frequency of injections. It was impossible to explain to them how an injection in the buttock would cure an ulcer elsewhere on the body, and, after one or two injections they would refuse to take more. Furthermore, the injections given during the night had to be the responsibility of indigene helpers or auxiliary students, and they were none too reliable. It might be mentioned in passing, however, that in almost every case in which penicillin therapy was begun this way, there was noticeable improvement in the surrounding cellulitis and inflammatory reaction after the second or even after the first injection.

For this reason it was decided to try penicillin locally in the form of wet dressings. After making smears for bacteriologic study, the ulcers were cleansed thoroughly, as much as possible of the false membrane or necrotic tissue was removed, and gauze soaked in a saline solution of 2,500 units of penicillin per cubic centimeter was applied.

Because of the limited quantity of penicillin at our disposal, dressings were changed only once daily and often would be found completely dry on the following day. Furthermore, as soon as the pain disappeared, it was impossible to keep these indigene patients from walking, thus adding additional trauma to a lesion which should have been kept at rest. However in spite of these adverse conditions the results were striking. Obviously penicillin had no selective action on the fusiform bacilli and spirilla which are constantly present in phagedenic ulcer, but also exerted a distinct bactericidal effect on the organisms responsible for the secondary infection.

In order to treat a large enough series of cases to justify drawing conclusions with the small amount of penicillin on hand, treatment as outlined was continued for 2 or 3 days after the ulcers were clinically clean and the fusiform bacilli and spirilla had disappeared, and then wet saline dressings were applied. None of the patients experienced pain on application of penicillin, and none showed the slightest evidence of skin irritation. Penicillin had no deleterious effects on the take of skin grafts. The 18 cases in this series are briefly summarized as follows.

CASE REPORTS

Case 1.—This patient complained of an ulcer, 9 by 6 cm., of 9 months' duration, on the back of the heel with exposure of the tendo achillis and necrosis of some of its fibers. Smears were positive for fusiform bacilli and spirilla. After 1 week of treatment, the ulcer was covered with healthy granulations which covered even the tendon. After 10 days of penicillin therapy, saline dressings were applied for 3 days, and the wound was skin-grafted with a good take over three-fourths of the surface area. The remainder of the ulcer healed spontaneously on the thirty-seventh day.

Case 2.—This patient had an ulcer 7 by 4 cm. of several weeks' duration on the dorsum of the foot. Smears were positive for the organisms characteristic of phagedena. After 3 days of penicillin therapy, the ulcer appeared clean and smears taken at that time were negative. It was thought that treatment could be discontinued, but on the eighth day there was evidence of a recurrence with some enlargement of the ulcer, more profuse discharge, and positive smears. Penicillin dressings were resumed on the tenth day, and there was almost immediate improvement. Smears were negative after 4 days, and saline dressings were substituted on the sixth day. Healing proceeded so rapidly that it was decided not to apply a skin graft. The wound was completely healed 1 month after discontinuing penicillin.

Case 3.—A patient with a recent phagedenic ulcer, 4 by 5 cm., of one month's duration, the smears of which showed great numbers of fusiform spirilla, was treated daily for 7 days with local applications of penicillin after which wet saline dressings were applied. Smears were negative on the fifth day. On this day there was practically no discharge or evidence of infection. The ulcer was healed completely on the thirty-fifth day.

Case 4.—A patient who had an ulcer 2 cm. in diameter, of 5 months' duration, the smears of which were positive for the organisms of phagedena, received 13 applications of penicillin in 16 days. The ulcer was clinically and bacteriologically clean in 12 days. After 2 more applications of penicillin, saline dressings were used, and spontaneous healing occurred in 22 days.

Case 5.—In this case in which there was an ulcer 10 cm. in diameter, of 10 days' duration, the smears showed great numbers of fusiform spirilla, and the patient experienced much pain, and there was marked swelling, and surrounding cellulitis. He was treated daily for 9 days when the wound was clean and granulating. Wet saline dressings were then applied for 3 days and the wound was covered with split skin grafts. There was a complete take and the wound was healed on the thirtieth day.

Case 6.—In this case the ulcer had been present for 8 years. It measured 15 by 9 cm. in diameter and was very dirty. Smears showed organisms typical of phagedena with secondary infection. The wound cleared rapidly and was clean at the end of a week of treatment with penicillin. After 10 days of penicillin therapy saline dressings were used for 3 days and the ulcer was skin-grafted. There was a good take, and the area was healed completely on the twenty-second day.

This case was noteworthy since the ulcer was of such long duration when the patient was seen for the first time.

Case 7.—An ulcer, 2 cm. in diameter, of 10 days' duration, the smears of which were positive for the characteristic organisms of phagedena, was treated with penicillin for 12 days during which time the patient received 10 applications of the drug. The false membrane had disappeared on the seventh day, and smears were negative on the eighth day. Saline dressings were substituted after the twelfth day of penicillin therapy and healing was complete in 19 days.

Case 8.—This patient's ulcer, 6 by 4 cm., of 2 months' duration, was accompanied by much pain, swelling, and surrounding cellulitis. The smears were positive for phagedenic organisms. The patient received 9 local applications of penicillin in 12 days. The ulcer was bacteriologically and clinically clean on the eighth day at which time the pain and swelling had disappeared. Penicillin therapy was continued for 3 more days, and then saline therapy was substituted. Spontaneous healing occurred in 33 days.

Case 9.—A native child had an ulcer 1½ cm. in diameter, of 3 weeks' duration. Characteristic organisms were found in the smear. The child reported for treatment irregularly and received only four treatments in 7 days. At this time the smears were negative for fusiform spirilla, and the bed of the ulcer was covered with healthy granulations. There was spontaneous healing on the twentieth day.

Case 10.—The patient had an ulcer 14 by 12 cm., of 1 month's duration, smears of which showed the typical organisms of phagedena. There was rapid improvement following penicillin therapy, and on the seventh day the wound was clinically and bacteriologically clean and healthy granulations covered the ulcer bed. Saline dressings were applied for 10 days and the wound was covered with split skin grafts. There was complete take of all the grafts.

Case 11.—In this case in which there was an ulcer, 5 by 10 cm., of 7 months' duration, there was exposure of the cortex of the fibula, and painful lymphangitis. Shortly after beginning the routine treatment, as carried out before penicillin was available, the patient developed measles and had to be sent to a hospital for contagious diseases. When he was again seen 2 months later, the ulcer had increased in size, and the patient was unable to walk because of pain. Smears of the ulcer material showed the presence of typical phagedenic organisms. On the seventh day of penicillin therapy, the false membrane of the ulcer had disappeared, and smears were negative on the eighth day. After 2 more days of penicillin therapy, the ulcer was covered with split skin grafts. There was complete take of the grafts and the wound was healed 42 days after the beginning of treatment.

Case 12.—This native had an ulcer 12 cm. wide on the lower third of his leg. The lesion was extremely painful although granulations were fairly clean. Smears showed characteristic organisms. Penicillin was applied locally for 14 days and at the end of that time smears were negative and the wound appeared clean. Saline dressings were then applied but there was evidence of recurrence of phagedenic ulcer and organisms again appeared on microscopic examination. Penicillin therapy was again instituted for 1 week, and on the eighth day split skin grafts were applied. There was complete take of the grafts and the wound healed promptly.

Case 13.—An ulcer, 8 by 6 cm., appeared on the right breast of a native

woman 23 years old. Its onset had been recent. This was the only ulcer in this series located elsewhere than on the extremities. It presented the typical appearance of a phagedenic ulcer, and smears were positive for the characteristic organisms. On the fifth day after local penicillin therapy was begun, the wound was completely clean, and smears were negative. After application of penicillin dressings for 2 more days, saline dressings were substituted. However on the twelfth day evidence of a recurrence was obvious, and smears made then showed numbers of fusiform spirilla. Penicillin dressings were resumed, and after 10 days the wound was clean and three-fourths of the surface area had healed spontaneously.

Case 14.—A native woman had an ulcer, 10 by 6 cm., which had been treated intermittently for 4 years. Smears were positive for fusiform spirilla. Seven days after beginning penicillin dressings, the wound was clean clinically and bacteriologically. Penicillin dressings were continued for 3 more days, and then saline dressings were substituted. It was planned to skin-graft the ulcer within a few days, but the patient requested delaying the operation so she could make some necessary domestic arrangements. Skin graft was done on the twenty-seventh day. There was a loss of two-thirds of the graft due to infection, and smears showed great numbers of fusiform spirilla. Application of penicillin dressings was begun again with rapid improvement in the clinical appearance of the ulcer, and within 3 days there was almost no discharge.

It was believed that better results would have been obtained in this case if we had delayed the skin graft a few days more and applied penicillin dressings until several smears had been found negative.

Case 15.—This patient had an ulcer involving the entire dorsum and tip of the great toe. There was osteomyelitis of the tip of the second phalanx which was exposed for half its length. Smears of the ulcer showed fusiform spirilla. There was rather marked cellulitis and secondary infection. After 5 days of penicillin dressings the ulcer was clean and no phagedenic organisms could be found. On the sixth day disarticulation of the second phalanx was done, and penicillin dressings were applied daily for 3 more days. There was rather rapid spontaneous growth of epithelium from all sides of the ulcer, and at this time (twenty-fourth day) it is almost healed.

Case 16.—This native had had a large ulcer of the leg, 10 by 12 cm., for 1 year. The lower third of the tibia was exposed and there was osteomyelitis. The patient had been treated in the hospital from 5 January to 2 March 1944 without penicillin and showed no noticeable improvement. Smears of the ulcer showed characteristic phagedenic organisms. On 3 March application of penicillin dressings was begun. After 7 applications the wound was remarkably clean with healthy granulations and with the only purulent discharge arising from the necrosed bone. Penicillin was discontinued on the eleventh day, and bacteriologic examination confirmed the clinical evidence of disappearance of the fusiform spirilla. Saline dressings were applied for 10 days. On the tenth day there was evidence of recurrence, and fusiform spirilla were again found in the wound.

Penicillin dressings were again employed and the wound was clean after

8 days. There was beginning epithelization from the skin borders. All evidence of the phagedenic nature of the ulcer had disappeared, although there remained the necessity of a sequestrectomy before healing could be expected.

Case 17.—In this case an ulcer developed in the scar of a former ulcer which had been cured without penicillin. The present lesion measured 6 by 4 cm. Examination of the smears confirmed the phagedenic nature of the ulcer. Treatment with penicillin was begun, but in this patient improvement was slow. He was treated rather irregularly, however, receiving 15 applications in 18 days. At this time a second ulcer appeared at the periphery of the first lesion. Penicillin therapy was continued, and on the fiftieth day, by which time he had received 34 treatments, the ulcers were fairly clean, but there were still fusiform spirilla in the smears. The first negative smears were obtained after the forty-eighth treatment, and even then there was little evidence of spontaneous healing. By this time the supply of penicillin was exhausted, and this form of therapy was discontinued.

Case 18.—This patient, a native child, had an ulcer of unknown duration, 10 by 5 cm., on the leg. Smears were positive for fusiform spirilla. The child was treated as an out-patient and reported very irregularly, receiving only 14 applications of penicillin in 28 days. After the fifth application, smears showed numerous fusiform bacilli but no spirilla. On the twenty-eighth day smears were still negative for fusiform spirilla, but there was still considerable discharge and evidence of secondary infection. There was, however, beginning evidence of spontaneous healing from the borders. The patient disappeared at this time, and the final result is unknown.

CONCLUSIONS

The results obtained in this relatively small series of cases would indicate that penicillin used locally in the form of wet dressings is perhaps the most efficacious of all forms of therapy that have been used in the treatment of phagedenic ulcer. It was remarkable how quickly the ulcers would become clean and the fusiform bacilli and spirilla would disappear. It is especially noteworthy when we consider that every patient in this series was a native and knew nothing about asepsis or even ordinary cleansing. When first seen, they usually had a dirty rag tied around the ulcer, which was soaked with the profuse purulent discharge from the lesion. Often they lived in the "bush" and would not even report for treatment until pain and inability to walk forced them to seek relief.

It is likely that better results might have been obtained if we could have used intramuscular injections of penicillin in conjunction with its local use. Further investigation is necessary before presuming to suggest a standard method of treatment. We do feel, however, that there can be no doubt as to the value of penicillin in the treatment of this condition which causes so much

disability, leads to many amputations, and has a relatively high mortality among people in tropical climates.



SODIUM FLUORIDE IN CONTROLLING HYPERSENSITIVE TEETH

The use of sodium fluoride is a comparatively new method of desensitizing dentin. This article concerns itself with the local application of NaF. The suggestion for use of this drug was described by Lukomsky and further experimented and demonstrated by Hoyt and Bibby (Tufts Dental School).

There is no definite evidence to explain the effect of sodium fluoride. The following are suggested as possible explanations:

1. Incorporation of NaF in the teeth might add to the ability to withstand the action of acids produced by bacterial fermentation. A similar experiment on reducing the solubility of rock phosphate was demonstrated by J. F. Volker.

2. NaF may penetrate the pulp and the receptive action to pain no longer exists.

3. NaF may add to the ability of the teeth to repair themselves. The reaction between sodium fluoride and the tooth substance is rapid and direct external application does reduce painful sensations.

The following method of application has been used:

1. Wall off area with cotton rolls.

2. Use a 33-percent NaF paste (NaF 1 part, white clay 1 part, glycerin 1 part) on a burnisher type instrument.

3. Burnish the NaF paste on the sensitive area, using a wiping motion.

4. The degree of pressure should be steady and vigorous until all pain disappears (ranging from 2 to 5 minutes).

It is advisable to explain to the patient that some pain (similar to a toothache) will be experienced for approximately 30 seconds to 1 minute. If sensitivity still exists after the initial application, wash off the area with a warm spray and a second treatment should be given immediately.

Sorrin suggested that instead of a hand burnisher, a smooth pear shaped engine burnisher employed will hasten the desired reaction.

In conclusion it should be remembered that all factors causing trauma or abrasion to the tooth must be eliminated.—LAZAROFF.
A., Lieutenant, junior grade (DC) U.S.N.R.

CHEMOTHERAPY, PYROTHERAPY AND PENICILLIN IN THE TREATMENT OF GONORRHEA

DAVIS H. PARDOLL

Lieutenant Commander (MC) U.S.N.R.

and

ROBERT L. DENNIS

Lieutenant Commander (MC) U.S.N.R.

Gonorrhea has always occupied a preeminent place among the leading causes of morbidity in the Navy. In 1942, it had attained editorial cognizance in many large cities, and ten of the leading ones contributed more than 50 percent of the cases in the United States. Through the combined efforts of both Public Health officials and medical officers of the armed forces, the incidence may, at times, show a decrease but will invariably bear a definite relationship to the particular localities being studied.

Several factors, in addition to its sociologic aspects, contributed to the epidemic stature of this disease. Many patients, apparently clinically cured, were being discharged without confirmation of cure by culture, and consequently served as carriers, thereby increasing the incidence. Furthermore, a definite and progressive increase in the refractory response to sulfonamide therapy was becoming apparent.

Our experience, also observed by others, demonstrated a steady increase in the number of sulfa-resistant cases. By the end of 1942, these failures numbered 30 percent; many of them developed an involvement of the posterior urethra with its attendant complications in spite of chemotherapy. The management of these patients by the usual accepted methods would require weeks or even months of further treatment in order completely to eradicate the infection. These facts made it obvious that, in order to reduce the number of sick days, effect a cure, and decrease the incidence of disease, more vigorous methods would have to be adopted.

Consequently pyrotherapy was instituted and was generally acclaimed as a most valuable adjunct to chemotherapy, particularly in the treatment of sulfonamide-refractory patients. This type of therapy resulted in approximately 80 percent cures.

Upon arrival in the Southwest Pacific area, all our previous deductions were confirmed. With the establishment of this base

hospital there was an immediate influx of patients infected with gonorrhea, 50 percent of whom had received chemotherapy prior to admission and had been found refractory.

This report is based upon a 4-month period beginning with the establishment of the hospital on 1 December 1943, and ending 1 April 1944. During this period 143 cases of gonorrhea were admitted to the urologic service; 23 additional patients were included up to 15 April 1944, making a total of 166 who received treatment. Of these, 94 had received no treatment prior to admission, and 72 had been treated previously and were found refractory to chemotherapy.

TABLE 1.—*Chemotherapy (small initial dosage, 20 to 50 gm.)*

	Number of patients	Cures	Failures	Cures percent
Group A.....	30	10	20	33.33
Group B.....	43	12	31	28.00

Upon admission patients with gonorrhea were divided into two groups. Group A consisted of those who had received no previous treatment; those in Group B had received various forms of therapy including sulfonamides and had proved refractory. Both groups were given one or more courses of sulfa drugs in dosages ranging from 20 to 50 gm. The preponderance of failures (table 1) demanded immediate remedial measures. Fever therapy was instituted and will be commented upon later. In spite of the favorable response to the latter, utilizing a double shift of personnel and treating four patients a day, the increasing number of sulfonamide-resistant cases presented a problem which demanded solution.

TABLE 2.—*Chemotherapy (small plus large dosage)*

	Number of patients	Cures	Failures	Cures percent
Group A.....	8	1	7	12.5
Group B.....	19	6	13	31.5

A number of failures from both Groups A and B who had received 20 to 50 gm. of chemotherapy were then placed upon one or more intensive courses of sulfonamides in larger dosages ranging from 60 to 80 gm. The response in Group A and Group B varied. An additional small number was cured (table 2). Those in Group B had been under treatment for varying lengths of time

prior to admission. Obviously, continuous treatment contributed to the larger percentage of cures in this group.

TABLE 3.—*Chemotherapy (large initial dosage, 60 gm.)*

	Number of patients	Cures	Failures	Cures percent
Group A.....	43	23	20	53
Group B.....	21	5	16	24

The patients in another series, upon admission, were given one or two initial courses of 60 gm. of sulfa drugs. Those in Group A responded with 53 percent of cures while the majority in Group B remained refractory (table 3). In many, if after one course response was unsatisfactory, further chemotherapy was discontinued.

An evaluation of our results with chemotherapy indicated that the previously accepted dosage of sulfonamides in the treatment of gonorrhea was inadequate. Consequently, the smaller dosage was abandoned in favor of larger initial dosage. Our present routine treatment is outlined under management of gonorrhea. With meticulous attention to adequate fluid intake and the addition of an equal amount of sodium bicarbonate, unfavorable reactions were reduced to a negligible number. Chemotherapy failures received either pyrotherapy or penicillin.

TABLE 4.—*Fever therapy (patients refractory to chemotherapy)*

Number of patients	1 treatment	2 treatments	3 treatments	Cures	Failures	Cures percent
27.....	14	5	1	20	7	74

Twenty-seven patients, all of whom were refractory to sulfonamides received pyrotherapy. Of this series, 14 were cured after 1 treatment; 5 after 2 and 1 after 3 (table 4). A relatively small number responded to additional treatments. Pyrotherapy was subsequently restricted to 2 sessions at 106° F. for a period of 5 hours. This reduction in the number of treatments was responsible for the smaller percentage of cures originally obtained. Several observations are worthy of comment. Temperatures under 105° F. are rarely lethal for the gonococcus. Elevation of the temperature above 106.5° F. or prolongation of the treatment beyond a 5-hour period is not desirable and is dangerous. Both increase the incidence of untoward reactions and are not warranted by the relatively slight increase in the number of cures.

By rigid adherence to these recommendations, pyrotherapy was rendered innocuous and was well tolerated. The technic is described under procedure for pyrotherapy.

Sixty-six patients, all of whom were refractory to chemotherapy, received penicillin; 7 had failed to respond to pyrotherapy. The success that attended the use of this drug was phenomenal; all were cured. In 3 favorable response was somewhat delayed. One patient who had suffered a relapse promptly responded after the drainage of a periurethral abscess; in another who received inadequate dosage (60,000) the condition cleared up following the injection of an additional 100,000 units. A third who developed an epididymitis responded after an additional 200,000 units.

TABLE 5.—*Penicillin (patients refractory to chemotherapy)*

Number of patients	40,000	60,000	70,000	80,000	100,000	200,000	Cures	Failures	Cures percent
66	1	6	1	1	56	1	66	0	100

Table 5 shows the various dosages employed. Injections were given intramuscularly at 3-hour intervals. Clinical improvement was observed after two injections in practically all cases treated with penicillin.

TABLE 6.—*Penicillin*

	100,000	Cures	Failures	Cures percent
Group A.....	17	17	0	100
Group B.....	6	6	0	100

From 1 April to 15 April 1944 an additional 23 patients received penicillin, all of whom were cured (table 6).

Laboratory investigations.—All patients showing a urethral discharge on admission, were sent to the laboratory where a plain smear and culture were obtained. The smear was stained by the Gram method, and a portion of the discharge was streaked on a chocolate agar plate.

Patients from whom a discharge could not be obtained by the usual method received a prostatic massage. If material could be obtained it was treated in the manner described above. If no prostatic secretion was obtained, the first 3 cc. of urine was passed into a clean, sterile test tube. This was centrifuged for 10 minutes at 1,200 revolutions per minute and the sediment cultured.

If material obtained by any of these methods did not show the

growth of gonococci the procedure was repeated in 1 week. If it remained gonococci-free the patient was returned to duty.

Upon completion of any course of treatment specimens were again obtained, stained and cultured. If gonococci were recovered the treatment was continued. Patients were regarded cured only after 3 cultures taken 1 week apart failed to show the presence of gonococci.

Materials and procedures.—The culture medium was prepared from Bacto Nutrient Agar (Difco) to which 4-percent sterile defibrinated human blood and 0.5 mg. percent of para-aminobenzoic acid were added. The pH was adjusted at 7.4 and the plates were poured in the usual manner (12 to 15 cc. per plate). These were incubated for 24 hours at 37° C. for sterility and were inverted in the refrigerator. Several hours before use they were again placed in the incubator where they assumed the temperature of 37° C.

When cultures were taken on the wards the culture plates were taken from the incubator and placed in a thermos container in which a temperature of 37° C. was maintained by a hot water jacket. This thermos container holds 12 plates and can be carried from ward to ward.

The genitals were washed with soap and water and dried with an alcohol sponge; the second drop of pus or discharge was obtained directly and was streaked upon the plate.

The plates were placed in an airtight incubator, a candle was lighted in the incubator and it was closed. This incubation in carbon dioxide tension was carried on for 24 hours at 36° C. At the end of this period if characteristic growth did not appear, the plates were incubated further in normal atmosphere for 24 hours at 37° C.

The plates were then treated with a 1-percent solution of dimethyl phenylenediamine hydrochloride and characteristic colonies were smeared and stained by the Gram method. Cases of scant growth or atypical reactions were carried into the sugars (dextrose and maltose preparations) for further confirmation. Four hundred eighteen investigations were carried out in this series of cases.

MANAGEMENT OF GONORRHEA

CHEMOTHERAPY.

A. Acute and refractory cases:

1. Sulfadiazine 2 gm. 5 times a day for 2 days.
Sulfadiazine 1 gm. 5 times a day for 8 days.
2. Equal amounts of sodium bicarbonate are given with all sulfa medications.

3. Patients are instructed to drink 2 glasses of water with each medication and 1 or more glasses between medication times.
4. Complications resulting from chemotherapy that must be reported to the ward medical officer are:
 - a. Fever and chills.
 - b. Skin rash.
 - c. Hematuria.
 - d. Conjunctivitis.
 - e. Nausea and vomiting.
 - f. Severe headache or backache.
5. At the end of 3 days these cases are examined and questioned for progress. If the patient fails to respond to sulfadiazine, the drug is discontinued and after a 48-hour rest period the patient is placed on a course of sulfathiazole 60 gm. in 10 days.
6. Laboratory examinations are repeated at the discontinuation of a sulfa course.
7. If the patient fails to respond to chemotherapy, he becomes a candidate for pyrotherapy or penicillin.

PROCEDURE FOR PYROTHERAPY.

A. Equipment required:

Table.
Mattress with rubber sheet cover.
Three wool blankets.
Canvas sack.
Rubber sheet.
Cotton pajamas.
Two cotton blankets folded in half for arms.
Two cotton blankets folded in half for legs.
Three cotton blankets to cover patient.
One glass and drinking tube.
Mouth thermometer.
Hypodermic tray.
Flask of 500 cc. 3-percent saline.
Sterile intravenous set.
Ampules of caffeine, coramine and epinephrine.
Thermal cabinet.

B. Preparation of patient prior to pyrotherapy:

1. Mental preparation.
 - a. Explain the complete procedure used during pyrotherapy; this will increase the patient's confidence in the treatment.
 - b. He must understand that he will be restrained throughout the procedure but that he will not be left alone.
2. Medical consultation.
3. Electrocardiograph.
4. Phenolsulfonphthalein test.
5. Complete blood count.
6. Urinalysis.
7. Blood Kahn test.
8. All sulfa drugs are discontinued 72 to 96 hours preceding pyrotherapy.

9. The orders below are routine for the day preceding pyrotherapy.
 - a. Sulfadiazine 1 gm. every 4 hours for 6 doses; if allergic to this drug, use sulfathiazole; if allergic to sulfathiazole, omit this order.
 - b. Multiple vitamin capsule every 4 hours for 6 doses.
 - c. Abundant fluids (milk 2,000 cc. and water 2,000 cc.).
 - d. Salt and soda enema at bedtime.
 - e. Light supper.
 - f. No breakfast.
 - g. Sodium amytal 3 grains at bedtime night before treatment.
 - h. Sodium amytal 3 grains 0630 morning of treatment.
 - i. To fever room at 0645.
 - j. 500 cc. 3-percent saline intravenously; have patient void when intravenous is finished. This is done before pyrotherapy begins.

C. Procedure:

1. Wrapping the patient for treatment.
 - a. Patient, who is wearing cotton pajamas, is wrapped so as to prevent any two body surfaces from coming in contact with each other, wrapping the arms by bringing the cotton blankets well under the back to restrain them. Do likewise with the legs.
 - b. After arms and legs are restrained, the patient is covered with three additional cotton blankets; another blanket folded in half is placed over the feet.
 - c. Rubber covered pillow is placed under the head of the patient.
 - d. Rubber air cushion is used to protect the sacral region and prevent pressure sores. Other bony prominences, such as the heels, must be protected by propping them up on a folded blanket.
 - e. The surgical thermal cabinet is then placed over the patient.
2. Care of the patient during treatment.
 - a. The temperature begins to rise in 30 minutes and the stage of excitement is reached at 101° F.
 - b. At this time the patient receives a hypodermic of morphine sulfate $\frac{1}{4}$ grain and scopolamine 1/200 grain.
 - c. When the temperature reaches 105.6° F. the cabinet is removed and the patient is wrapped in the canvas sack. The patient then receives a second hypodermic of pantopon $\frac{1}{8}$ grain. Sodium amytal or pantopon $\frac{1}{8}$ grain may be repeated if necessary.
 - d. Temperature, pulse and respiration are taken every 5 minutes and recorded every 15 minutes during the treatment.
 - e. Treatment starts after the temperature reaches 106° F. It is maintained at this level for 5 hours. If the temperature rises above the desired level the patient's face is cooled with ice packs. If the temperature still continues to rise, the chest is exposed and cold packs are applied to it. However it may still be necessary to expose an arm or both arms to bring the temperature down to the desired level. Should the temperature fall, blankets are added over the canvas sack.
 - f. Sips of warm fluids or tap water are allowed, but the drinking of too much is discouraged, as it may produce distention of the stomach with nausea and vomiting.

- g. Contraindications such as pulse beat over 160, respirations below 12, or circumoral pallor require special attention and treatment must be discontinued.
 - h. Complications such as heat cramps, acute abdominal pain or cardiac pain, and numbness of the extremities also require special observation, and treatment may have to be discontinued.
 - i. The rising of temperature to excessive heights is dangerous and must be treated by the following methods:
 - 1. Remove cabinet and uncover patient immediately.
 - 2. Apply ice to body.
 - 3. 1,000 cc. 5-percent dextrose in normal saline solution intravenously.
 - 4. Cold fluids by mouth.
 - 5. Rectal stimulation if coma ensues.
 - 6. Artificial respiration with oxygen if respiratory difficulty occurs.
 - 7. Caffeine and sodium benzoate, $7\frac{1}{2}$ grains, or nikethamide for stimulation if necessary.
 - j. Zinc oxide ointment is applied to the lips to prevent cracking or herpes. Nevertheless, 70 to 80 percent of the patients develop herpes. Best results in the treatment of this condition are obtained by the application of ethyl nitrate.
3. Care of patient after pack is removed:
- a. Unwrap patient and give cool sponge bath and alcohol rub. When temperature drops to 100° F. give 1,000 cc. 5-percent dextrose in normal saline solution intravenously.
 - b. Blood pressure and temperature are taken every 30 minutes for the first 4 hours; then every hour for the next 4 hours. The patient is returned to the ward when the temperature drops to normal, which usually takes about 1 hour.
- D. Procedures for secondary rise in temperature:
- 1. If temperature rises to 100° F.:
 - a. Cool sponge to face and neck.
 - b. Abundant fluids.
 - c. Ice bag to head.
 - 2. If temperature rises to 102.6° F.:
 - a. Sponge entire body with cool water.
 - b. Abundant (cool) fluids.
 - 3. If temperature rises to 103° F.:
 - a. 1,000 cc. 5-percent dextrose in normal saline solution intravenously.
 - b. Ice packs to entire body.
 - c. Nembutal $\frac{1}{2}$ grain or sodium amytal 3 grains for restlessness.
- E. When any doubt arises as to the patient's ability to tolerate pyrotherapy, STOP TREATMENT.

CONCLUSIONS

- 1. Gonorrhea is showing a definite increase in its resistance to treatment with sulfonamides.

2. The previously accepted dosage of both sulfadiazine and sulfathiazole is inadequate; approximately 70 percent of patients fail to respond.

3. The number of cures is increased by the use of a larger initial dosage of these drugs, i.e., 60 gm.

4. Meticulous attention to adequate fluid intake and the addition of an equal amount of sodium bicarbonate reduce reactions to a negligible number.

5. Infections which fail to respond to two courses of sulfonamides should be treated as failures. Only a small percentage respond to subsequent courses. Further chemotherapy is based upon hope rather than the result of experience.

6. Phimosis, stenosis of the meatus, stricture of the urethra, periurethral abscess and cowperitis demand appropriate treatment.

7. Pyrotherapy is a valuable adjunct in the management of sulfa-resistant gonorrhea. The majority of patients are cured by one treatment; a few by two.

8. Two sessions of pyrotherapy between 106° and 106.5° F. for a period of 5 hours are adequate. Additional treatments, higher temperatures, and prolongation beyond 5 hours are not warranted in view of the increased hazards as well as of the majority of persistent failures.

9. Treatment with penicillin resulted in 100 percent of cures in 89 patients treated with this drug.

10. Although penicillin eradicates the gonococcus from smears and cultures, the end-results of complications such as epididymitis, prostatitis and arthritis may require additional care.

11. The simple stained smear is an unsatisfactory criterion of cure. Twelve percent of our cases showed negative smears and positive culture.

12. Culture appears to be an adequate method of determining cure. In this series, patients who showed persistent negative cultures were free of symptoms and showed no further discharge.

PENICILLIN IN SULFONAMIDE-RESISTANT GONORRHEA

SUPPLEMENTARY REPORT OF 144 CASES¹

JOHN G. MENVILLE

Lieutenant Commander (MC) U.S.N.R.

and

CLARENCE W. ROSS

Captain (MC) U.S.N.

In the September issue of the *BULLETIN* a preliminary report was published on 124 cases of sulfonamide-resistant gonorrhea treated with penicillin. A comparison of the results in the treatment of 144 cases of sulfonamide-resistant gonorrhea with the 124 cases previously reported is in order. The plan of treatment in this latter series was more firmly established, and the results proportionately better.

In general, in the uncomplicated cases 100,000 units were given intramuscularly (15,000 units in 3 cc. of normal saline solution) every 3 hours.

In the complicated cases 100,000 units were given intravenously and 200,000 units intramuscularly daily until it was established that the patient was cured. The intravenous dose was administered as a continuous infusion in 2,000 cc. of normal saline solution at the rate of 20 drops per minute. The intramuscular dose was given in 25,000 units in 5 cc. of normal saline solution every 3 hours.

It is believed that the 25,000 units intramuscularly every 3 hours in the above routine is a larger dose than necessary, but since penicillin comes in 100,000-unit ampules, this dosage enables the patient to receive the drug by both routes of administration in 24 hours. Experience at this activity has shown that the above routine has caused less confusion among the rapidly changing personnel of the hospital than the 15,000-unit dosage which requires carry-over doses into the second 24-hour period.

Of 144 cases, 118 presented no complications, and of this number 13 occurred in colored men. One case was thought to be a recurrence of an infection previously treated by penicillin.

Of 118 patients with uncomplicated cases, 116 were given 100,000 units intramuscularly as an initial course, and all but one

¹ MENVILLE, J. G., and ROSS, C. W.: Penicillin in sulfonamide-resistant gonorrhea; preliminary report of 124 cases. *U. S. Nav. M. Bull.* 43: 423-428, September 1944.

patient responded to this therapy. The one not responding required an additional 200,000 units intramuscularly to effect an apparent cure. The two remaining patients were given 200,000 units intramuscularly as an initial course and both responded to treatment.

Of the 144 cases of gonorrheal urethritis, 26 presented complications exclusive of posterior urethritis; none of these occurred in the colored men. The complications were:

Gonococcal infection of the prostate.....	14 cases
Gonococcal infection of the prostate and the epididymis..	2 cases
Gonococcal infection of the epididymis.....	6 cases
Gonococcal infection of both epididymides.....	1 case
Intra-urethral verruca accuminata.....	2 cases
Multiple arthritis.....	1 case

RESULTS OF TREATMENT

Gonorrheal prostatitis.—15 cases: Two cases responded to treatment with 100,000 units intramuscularly but six failed to respond. The latter cases required subsequent penicillin for a cure. In one of these latter cases, an epididymitis developed after the original course of penicillin had been given. Two cases responded to treatment with 200,000 units intramuscularly, and five cases responded to treatment with 100,000 units intravenously and 200,000 units intramuscularly.

Gonorrheal epididymitis.—8 cases: One patient who had gonorrheal urethritis developed an epididymitis after being given 100,000 units of penicillin intramuscularly. Subsequently intensive continuous penicillin therapy for 5 days did not shorten the course of the epididymitis. One patient who had an associated prostatitis did not respond to the routine therapy, and an additional 200,000 units intramuscularly were necessary for an apparent cure. One patient did not respond to 100,000 units intravenously and 200,000 units intramuscularly and required further penicillin therapy. Three cases responded to therapy with 100,000 units intravenously and 200,000 units intramuscularly daily for 2 days. Two cases responded to 100,000 units intravenously and 200,000 units intramuscularly daily for 6 days. One of the two patients had a bilateral infection.

Intra-urethral verruca accuminata.—2 cases: One case responded to penicillin therapy with 100,000 units intramuscularly. One did not respond to therapy with 200,000 units intramuscularly but subsequent intensive penicillin therapy produced an apparent cure.

Multiple arthritis.—1 case: This patient had had a gonorrheal urethritis of long standing which failed to respond to intensive sulfonamide therapy. On admission he suffered from a stiffness of both temporomandibular joints and a persistent, positive urethral discharge.

Sulfadiazine therapy was instituted and after several days the patient developed symptoms of acute arthritis of the left knee. He was given 200,000 units of penicillin intravenously daily for 3 days with little improvement. Improvement of the temporomandibular symptoms followed similar treatment for an additional 4 days. After this, 200,000 units were administered intravenously and another 100,000 units by the same route on the following day. On this day infection spread to the right knee.

The patient was then given 100,000 units of penicillin intravenously and 50,000 units intramuscularly daily for 3 days, with cessation of symptoms in the right knee and an improvement of symptoms in the left knee. Following this, 25,000 units were injected into the left knee joint daily for 5 days. All signs of infection disappeared from the left knee, but at this time a positive urethral smear was found. The patient was then given 100,000 units intravenously and 200,000 units intramuscularly daily for 2 days. Following this, four consecutive negative urethral smears and three consecutive negative prostatic cultures were obtained before a fifth urethral smear was found to be positive. Doses of 100,000 units intravenously, and 200,000 units intramuscularly daily were then given for 4 days, resulting in an apparent cure.

Although no culture of the joint cavities was taken, the clinical evidence in this case was believed to justify the diagnosis of gonorrheal arthritis. X-rays of the knee joints showed no abnormality.

Latent infection.—3 cases: In 144 cases of gonorrheal urethritis, latent positive smears, or cultures, were found in three cases, all presenting complications. One case was that of the multiple arthritis infection already described; the other two were gonococcal infections of the prostate. In the first of the latter two cases treatment with 100,000 units of penicillin intramuscularly was followed by five consecutive negative urethral smears, and four consecutive negative prostatic cultures before a sixth urethral smear was positive. Subsequent penicillin therapy produced an apparent cure. In the second case after 100,000 units of penicillin had been given intramuscularly a urethral smear was positive. One hundred thousand units intramuscularly and 200,000 units intravenously were then followed by three consecu-

tive negative urethral smears and three consecutive negative prostatic cultures before a fourth prostatic culture was positive. Subsequent penicillin therapy produced an apparent cure.

CONCLUSIONS

1. One hundred forty-four cases of sulfonamide-resistant gonorrhea were treated and apparently cured by penicillin.

2. One hundred fifteen cases, or 99.1 percent, of uncomplicated cases responded to one course (100,000 units intramuscularly) of penicillin.

3. The majority of the complicated cases were best treated by simultaneous intramuscular and intravenous injections of penicillin.

4. Gonorrheal arthritis is believed to respond best to simultaneous injections of penicillin into the joint, muscle, and vein.

5. There is a small percentage of latent infections following treatment with penicillin; this has been found to be particularly true in the complicated cases.

6. The development of an epididymitis following a course of penicillin is evidence that penicillin does not always eradicate the gonococcus in one course, and is a warning to all who would check for a cure of the disease too early or too vigorously. Such cases do not respond readily to further penicillin therapy.



UNTOWARD EFFECTS AND COLOR OF PENICILLIN

In those patients who received penicillin intrathecally every twelve hours, as well as in some individuals who were given intrathecal doses of 15,000 units, more severe and more persistent headaches were noted, fever was prolonged and signs of meningitis subsided more slowly. Penicillin produced by different manufacturers caused various degrees of meningeal irritation. Thus, the dark brown product was found to have the greatest irritant effect and caused febrile reactions, whereas the pale yellow product had the least demonstrable irritant effect. It is our belief, therefore, that the dark brown powder should not be used intrathecally. —ROSENBERG, D. H., and ARLING, P. A.: Penicillin in treatment of meningitis. J. A. M.A. 125: 1011-1017, August 12, 1944.

PENICILLIN IN TREATMENT OF RHEUMATIC FEVER AND GONOCOCCAL INFECTIONS^{1,2}

JOHN R. TWISS
Commander (MC) U.S.N.R.

Penicillin, generally speaking, has been reserved for the treatment of infections considered critical, for those in which its use has proved specific, and for those in which no specific treatment is available. Rheumatic fever is generally considered a condition for which we have no specific treatment. White, and other authorities, have agreed that salicylates are useful only for their antipyretic effect, and that the use of salicylates neither has a specific effect upon the disease nor shortens the period of disability.

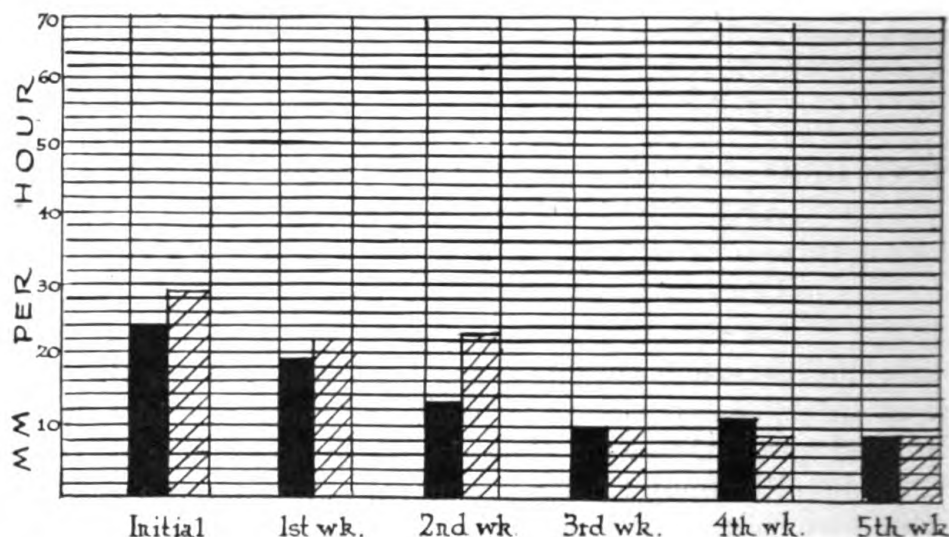
Rheumatic fever has been described recently by Coburn (1) and Master (2) as one of the major health problems of the Navy. War conditions have greatly accentuated the problem, because of the increased incidence of hemolytic streptococcus infections attendant upon the crowded conditions which are inevitable. It is apparently conceded at the present time that the streptococcus plays an important role in the pathogenesis of rheumatic fever.

The empirical treatment of 10 rheumatic fever patients with penicillin was considered justified for several reasons, notwithstanding opinions previously expressed that penicillin would be of no value in rheumatic fever. However, no published reports on the use of penicillin in this disease have come to our attention. Furthermore, efforts to shorten the duration of the disease process seemed indicated because of the tremendous economic loss attendant upon a disease with an average morbidity period of 4 months, from the viewpoint of loss of services, possible permanent disability, and cost of hospitalization.

In order to establish, for control purposes, the usual course of rheumatic fever for Naval personnel under similar conditions, an investigation was made of a series of 20 comparable patients having rheumatic fever of average severity. These patients were treated in the same way as the above cases, except that no penicillin was administered, i.e., with a standard routine of salicylates, bed rest, high vitamin diet, and vitamin supplements.

¹ With discussion by Commander Ellif C. Hanssen (MC) U.S.N.R.

² Read before California Heart Assn., 6 May 1944.



Comparative study of average sedimentation rates in the groups of patients treated with and without penicillin; control group solid black, group with penicillin cross-hatched.

In the control series, the average period of sickness before admission was 6 days. The average period of bed rest of 51 days was followed by an ambulatory period of 37 days. After this there was a convalescent leave period of 25 days, making the total average period of disability 119 days. Salicylates were given orally in an average dosage of 10 gm. daily, and continued for an average period of 35 days. The average initial sedimentation rate was 24 mm. in 1 hour. The average rate of fall may be seen in the accompanying chart; a normal sedimentation rate is reached by the third week.

ACUTE RHEUMATIC FEVER

Five patients who had acute rheumatic fever were treated with penicillin and salicylates.

Case 1.—The patient, 35 years old, was admitted to the hospital on 31 January 1944 with a history of having had a cold and sore throat followed by a painful swelling of the right foot, of 4 days' duration. There had been an attack of generalized "acute arthritis" 10 years before admission. Physical examination on admission showed the temperature to be 101° F., the pulse rate 86, and respirations 20 per minute. The entire right foot was very red, acutely tender, and swollen. There was slight similar involvement of the left foot. A cardiac apical systolic murmur developed shortly after admission. The sedimentation rate was 27 mm. in 1 hour, the erythrocyte count 3,600,000, the hemoglobin content 75 percent.

Treatment consisted of 12 gm. of sodium salicylate every 24 hours. The fever gradually subsided and became normal on the third day, with a slight improvement in the joint condition. The salicylates were then discontinued

and 500,000 units of penicillin given intramuscularly, 40,000 units being the initial dose. For 24 hours 10,000 units were given every 2 hours and thereafter 10,000 units every 3 hours. During this period of treatment there was a recurrence of an intermittent fever of 101° to 102° F., with no further relief of joint symptoms. The penicillin was therefore discontinued and the salicylates resumed, with prompt subsidence of the fever and joint symptoms. The apical murmur disappeared and the sedimentation rate became normal in 3 weeks, after which the patient made an uneventful recovery.

Case 2.—A chief boatswain's mate, 33 years of age, was admitted on 1 February 1944 with the complaints of pain and swelling in the right foot, ankle, and the left wrist, of 3 weeks' duration. There had been a continuous cold in the head for 3 months preceding the onset of joint symptoms. The past history revealed nothing pertinent except recurrent acute tonsillitis during childhood. On admission the temperature was 101° F., pulse rate 64, and respirations 18 per minute. Physical examination showed swelling, redness, and tenderness of the left hand and right foot. There were systolic murmurs at the apex of the heart and in the aortic area.

Treatment consisted initially of sodium salicylate, 8 gm. daily, following which there was no relief of joint symptoms. There was a gradual subsidence of fever, the temperature becoming normal on the third day. The salicylates were then discontinued, and a course of 500,000 units of penicillin was given intramuscularly, as previously described. Again there was a recurrence of slight fever, with no relief of joint symptoms. These symptoms were promptly relieved upon resumption of the salicylates. The sedimentation rate became normal in 2 weeks and the patient made an uneventful clinical recovery. The apical and aortic murmurs, however, persisted.

Case 3.—A fireman, first class, 18 years old, was admitted on 4 February 1944 complaining of pain in the left thigh and swelling of the left foot of 4 days' duration. There had been transient pains in both knees at the abrupt onset of the acute illness, which had followed a moderately severe infection of the upper respiratory tract of 2 weeks' duration.

On admission the temperature was 102.2° F., the pulse rate 100 per minute, and the respirations 25 per minute. The tonsils were hypertrophied and cryptic. The left ankle was swollen, red, and tender, and the knees were painful and tender. The heart was enlarged and there was a pulmonic systolic murmur.

A course of 750,000 units of penicillin was given intramuscularly, in accordance with the schedule previously described. For 4 days there was an intermittent fever of 102° F., with no relief of joint symptoms. Relief from joint symptoms and subsidence of fever occurred after 48 hours of the usual salicylate routine. The heart became normal in size after 5 weeks, although the murmur persisted for 8 weeks. The sedimentation rate increased from 25 mm. to 30 mm. in 1 hour during treatment, but returned to normal after a period of 5 weeks. The patient made an uneventful clinical recovery.

Case 4.—A seaman, second class, 20 years old, was admitted on 24 February 1944 complaining of severe aching pains of 5 days' duration in the left foot, knee, and legs. For 2 weeks preceding the onset of symptoms the patient had had a cold in the head. On admission the temperature was 101.8° F., pulse rate 90, and respirations 20 per minute. There was an apical systolic murmur and marked swelling of the left foot with tenderness, especially of the

toes. Laboratory tests yielded normal results except for a sedimentation rate of 26 mm. in 1 hour.

Salicylates were administered, 8 gm. daily, in the routine manner. Penicillin administration was begun concurrently on the second day, an initial dose of 50,000 units being followed by doses of 10,000 units, until the total dosage was 950,000 units. An intermittent fever of 102° F. subsided gradually after 2 days, the apical systolic murmur disappeared after 5 days, and the sedimentation rate became normal in 3½ weeks. The patient is now doing well and is ambulatory under observation.

Case 5.—A steward's mate, third class, 18 years old, was admitted on 3 March 1944 with the complaint of pain in the knees, hips, and ankles, of 3 days' duration. Three weeks before admission the patient had had a catarrhal fever of 10 days' duration. Three years before admission there had been an attack of acute rheumatic fever lasting 3 months.

On admission the patient's temperature was 100.4° F., pulse rate 112, and respirations 28 per minute. Physical examination showed swelling of the feet and knees with tenderness of the knees and hips. There was an apical systolic murmur. The sedimentation rate was 18 mm. in 1 hour. Treatment consisted of penicillin, 620,000 units administered in the routine manner. With this was given 8 gm. of sodium salicylate daily. The fever gradually subsided, reaching 99° F. on the third day. There was relief of joint pains, but persistent tenderness. The sedimentation rate became normal in 5 weeks.

A comparison of the results of treatment in the control group in which only salicylates were given and the group treated with penicillin and salicylates, indicates that the patients treated with penicillin were older, more acutely ill, and had higher initial sedimentation rates than those patients used as controls. Penicillin alone had no apparent clinical effect upon the acute stage of the disease, and its use did not seem to shorten either its severity or the duration of disability. The average sedimentation rates in the control and treated groups are shown in the accompanying chart.

Although no conclusions are warranted, the evidence furnished by the study of the 5 acute cases treated with penicillin disclosed no immediate therapeutic effect attributable to this agent. Its further use in the treatment of acute rheumatic fever therefore seems unjustified.

CHRONIC RHEUMATIC FEVER

The effect of penicillin was studied in 3 patients with chronic rheumatic fever. The findings in these patients were persistent auriculoventricular block, and elevation of the sedimentation rate, neither of which had responded to prolonged periods of treatment with rest, salicylates, diet, and other general therapeutic measures.

Case 1.—A fireman, second class, 29 years of age, was admitted on 3 December 1943 with a history of pain of 6 days' duration in the knees and legs. On admission the patient's temperature and pulse rate were found to be normal. There was swelling and tenderness of the right knee, and a faint

apical systolic murmur. The electrocardiogram showed a P-R interval of 0.26 second, which was considered evidence of a partial auriculoventricular block. The sedimentation rate was initially 27 mm. in 1 hour. At the beginning of penicillin therapy it was 5 mm. in 1 hour. The erythrocyte count was 3,500,000, the hemoglobin content of the blood 75 percent.

Treatment consisted of sodium salicylate, 10 gm. daily, for 6 weeks. During this period there was a subsidence of symptoms and the temperature remained normal. The auriculoventricular conduction time, however, remained elevated, while the sedimentation rate varied from 9 to 15 mm. per hour. After 12 weeks the sedimentation rate remained consistently elevated, and the P-R interval remained 0.26 second. One million units of penicillin were given intramuscularly in accordance with the usual schedule. After 3 weeks of further observation, the sedimentation rate became normal. The P-R interval, however, has remained 0.26 second.

Case 2.—A seaman, second class, 30 years old, was admitted on 7 December 1943 with a history of having had rheumatic fever 4 months previously. The sedimentation rate had become normal but there was persistent disability associated with a partial auriculoventricular block. The P-R interval was 0.28 second, the sedimentation rate 6 mm. in 1 hour.

Treatment consisted of one million units of penicillin, given in the routine manner. During this period there was no clinical change in the condition of the patient. At the conclusion of this treatment, the sedimentation rate of the blood was 5 mm. in 1 hour, and the P-R interval 0.26 second.

Case 3.—An officer, age 37, was admitted on 8 December 1943 after 2 months' hospitalization in another activity for transient pain in the right knee. For 19 years there had been periods of recurrent pain in the ankles and knees, at times associated with urethral discharge and diarrhea. On admission, the patient's temperature was found to be normal and the sedimentation rate was 22 mm. in 1 hour. The electrocardiogram showed a partial auriculoventricular block, with the P-R interval 0.26 second.

Treatment consisted of routine salicylates as previously described. The sedimentation rate after 4 months of treatment, however, varied between 20 and 30 mm. per hour, and there was no diminution in the prolonged conduction time. The administration of penicillin was begun on 3 February, one million units being given intramuscularly in accordance with the described routine. The sedimentation rate fell to 15 mm. in an hour on the 18th day and to 10 mm. in an hour on the 28th day. Although the patient is now clinically improved, there remains a prolonged P-R interval of 0.24 second.

COMPLICATIONS OF RHEUMATIC FEVER

The third portion of this study concerned the use of penicillin in the treatment of acute streptococcal complications of rheumatic fever. The use of penicillin in such complications may be of great importance, because it has been our experience, as well as that of others (3) (4) that the sulfonamides appear to aggravate rheumatic fever. Cases are therefore presented which illustrate the value of penicillin in these infections.

Case 1.—A fireman, first class, age 21 years, was admitted on 13 February

1944 with a diagnosis of rheumatic fever. He complained of fever and joint pains. He had previously had a draining left ear, which was dry on admission. The sedimentation rate on admission was 25 mm. in 1 hour and the leukocyte count 18,000. The patient was treated initially with bed rest and 10 gm. of salicylates daily. One week after admission there was a recurrent fever, followed by a discharge from the left ear. Culture of the discharge showed *Streptococcus haemolyticus*. X-ray examination showed destruction of the mastoid cells.

On million units of penicillin were given intramuscularly, in accordance with the schedule described, and the salicylate therapy was continued throughout the course of illness. The symptoms and fever promptly subsided following the use of penicillin. The ear discharge was appreciably less in 24 hours, and had disappeared entirely in 48 hours, at which time the temperature became normal. The rheumatic fever subsided after a mild, average course, and the patient is now clinically well.

Case 2.—A fireman, first class, age 25, was admitted on 14 January 1944 with the diagnosis of rheumatic fever. An acute otitis media developed on 17 March, with acute pain and fever. The following day the ear drum ruptured spontaneously; however severe pain and fever persisted. Cultures of the ear discharge showed *Streptococcus haemolyticus* and a gram-positive staphylococcus.

Treatment consisted of 800,000 units of penicillin, given as previously described. Following this penicillin therapy, the temperature, pulse and blood sedimentation rates became normal within 72 hours. The pain and ear discharge entirely disappeared during this time, and the rheumatic fever has become quiescent.

GONOCOCCAL INFECTIONS

The remarkable results with penicillin in treatment of gonococcal infection of the urethra are striking, even in the numerous cases found to be resistant to the sulfonamides after months of treatment.

The present series consists of 389 patients, treated in two Naval hospitals between 1 August 1943 and 20 April 1944 on the urologic service. The method of treatment and the results are shown in the accompanying table.

One patient having a prostatitis and severe epididymitis required 400,000 units of penicillin for a cure. There were no failures in the entire group, based upon repeated negative urethral smears and cultures and prostatic cultures. Urethral smears were studied both by the laboratory and the ward medical officer over a period of 1 month.

It is noteworthy that the first 160 patients treated had been ill for an average of 47 days. These patients were all returned to duty within 11 days after penicillin treatment. The last 229 had been ill for an average period of 6 days, the average period of hospitalization in this group being 5 days. Among patients pre-

389 gonococcal infections of urethra treated with penicillin

Number of cases	Dosage =units	Method	Results
20	160,000	Intravenous	All cured.
97	160,000	Intramuscular	"
14	50,000	"	5 cases required an additional 100,000 units; all cured.
258	100,000	"	3 cases required an additional 100,000 units; all cured.

viously treated, 240 had had a minimum of 2 five-day courses of sulfonamides.

SUMMARY

1. A study was made of the effects of treatment with penicillin on 5 patients with acute rheumatic fever, 3 patients with rheumatic fever in a chronic stage, and 2 rheumatic fever patients who were suffering with acute intercurrent streptococcal complications. A brief résumé also was given of the results of penicillin treatment in 389 cases of gonorrhea.

2. There was no evidence that penicillin was of value in the treatment of rheumatic fever either in the acute or chronic stages. In patients with chronic rheumatic fever associated with a persistently high sedimentation rate, however, there was a gradual reduction in the sedimentation rate to normal following the use of penicillin.

3. Penicillin was of dramatic therapeutic value in two rheumatic fever patients who had streptococcal complications; the sulfonamides are now thought to be contraindicated in this condition.

4. No untoward effect of penicillin on rheumatic fever was noted.

5. As has been noted by others, penicillin was highly effective in the treatment of gonorrhea.

REFERENCES

1. COBURN, A. F.: Disposition of patients stigmatized with rheumatic disease. U. S. Nav. M. Bull. 41: 1695-1701, November 1943.
2. MASTER, A. M.: Rheumatic fever in the Navy. U. S. Nav. M. Bull. 41: 1019-1021, July 1943.
3. COBURN, A. F.: Management of Navy personnel with rheumatic fever. U. S. Nav. M. Bull. 41: 1324-1328, September 1943.
4. SWIFT, H. F.; MOEN, J. K.; and HIRST, G. K.: Action of sulfanilamide in rheumatic fever. J.A.M.A. 110: 426-434, February 5, 1938.

Discussion of Commander Twiss' paper by Eilif C. Hanssen,
Commander (MC) U.S.N.R.

Having had no personal experience in the use of penicillin in cases of rheumatic fever, I found Commander Twiss' research in that field of especial interest. Though Dr. Twiss found penicillin without beneficial effect in rheumatic fever, his observation that penicillin works with dramatic effect in certain complications of rheumatic fever seems to me to be especially significant.

Our experience in the treatment of cases of gonococcus infection of the urethra at the U. S. Naval Hospital, San Diego, has been similar to that reported by Dr. Twiss, and our cures have been practically 100 percent in this field.

I was pleased to learn that Dr. Twiss advocates the intramuscular method of administration. Intramuscular injection eliminates the occurrence of infusion chills due to pyrogens. As regards reactions, our experience in San Diego has been similar to that of Dr. Twiss. Infrequent urticaria has been the only reaction observed as directly attributable to the penicillin therapy.

At the Naval Hospital in San Diego, from July 1943 to April 1944, 1,101 patients with a variety of diseases were treated with penicillin. In August 1943, a symposium on penicillin was held. Twenty-five cases treated with penicillin were reported; all were successes. At the time, we were warned of being overly optimistic as regards the effectiveness of penicillin; a more cautious evaluation was advised. With the passage of time and an increase of our series from 25 to 1,101 cases, we have not had to express ourselves less enthusiastically as regards the excellence of our results with penicillin.

Of the 1,101 cases treated, successful results were obtained in 1,052 or 96 percent. The failures have usually occurred in cases known to be penicillin-resistant. With few exceptions, whenever penicillin was used to combat penicillin-susceptible organisms, a successful outcome has been the result. A summary of the cases is shown in the accompanying table.

The cases were treated by the various ward medical officers. Usually the penicillin was given intramuscularly, 10,000 units in 2 cc. of distilled water every 3 hours day and night, a total of 80,000 units a day. When indicated the drug was given intravenously, intrathecally, intra-articularly, or in the pleural cavity.

In cases of gonococcus infection of the urethra the total dose given was 75,000 units and treatment was routinely discontinued after 24 hours. Urethral smears were negative with rare exceptions. In all other conditions the injections were continued until the temperature became normal and remained so for 48 hours. Individual total dosage varied from 75,000 to 5,560,000 units. Occasionally, a second temperature rise occurred, which promptly subsided after a second course of penicillin injections and did not recur.

To report that we have had 96 percent successes with the use of penicillin does not adequately tell the story of how successfully penicillin works. Not only does penicillin cure the patient, but it cures him rapidly, sometimes within 24 hours; it cures him safely, without danger of serious reactions;

it cures him inexpensively, reducing his period of morbidity from many months, in some cases to a few days or a few weeks.

1,101 cases treated with penicillin from July 1943 to 1 April 1944

Diagnosis	No. cases	Av. total dose	Success	Failure
Abscess, abdominal wall	1	250,000	1	
Abscess, cerebral	1	60,000		1
Abscess, cerebellar	1	100,000		1
Abscess, neck	2	700,000	2	
Abscess, kidney	1	200,000	1	
Abscess, retrorectal	1	200,000	1	
Abscess, perinephritic	1	300,000		1
Abscess, perivesical	1	500,000	1	
Abscess, scrotum	1	100,000		1
Abscess, leg	1	500,000	1	
Abscess, lung	1	5,560,000	1	
Abscess, forearm	1	600,000	1	
Acne, pustular, generalized	1	200,000	1	
Acne, pustular, face, chest	3	1,200,000	3	
Acne vulgaris	1	960,000	1	
Angina, Ludwig's	1	285,000		1
Bubo, inguinal, nonvenereal	1	75,000		1
Bronchiectasis	1	190,000	1	
Burn, electricity	1	600,000	1	
Cerebrospinal fever, meningococcic	3 ^{(1 case} 2 cases	1,536,000	1	
Cellulitis	32	230,000	1	1
Cicatrix, foot, draining	3	300,000	31	1
Cholangitis, chronic	1	600,000	3	
Cyst, retention, cervical	1	560,000	1	
Coccidioid granuloma	1	120,000		1
Dermatitis, infectious	1	400,000		1
Erysipelas, face	3	920,000	3	
Erythema multiforme	2	450,000	2	
Endocarditis, subacute, bacterial	2	800,000	2	
Enteritis, regional	2	910,000		2
Furunculosis	1	700,000		1
Fracture, compound	1	100,000		1
Gonococcus infection, urethra	9	500,000	8	1
Gonococcus infection, conjunctiva	865	75,000	865	
Gonococcus infection, joint	2	150,000	2	
Gangrene, leg	1	1,300,000	1	
Injuries, multiple, extreme	1	400,000	1	
Iridocyclitis	1	100,000		1
Lymphadenitis	1	100,000		1
Lymphogranuloma venereum	3	300,000	2	1
Mastoiditis, acute	1	75,000		1
Mastitis, acute	7	400,000	6	1
Malaria	1	200,000		1
Osteomyelitis, frontal bone	1	1,250,000		1
Osteomyelitis, tibia	1	200,000	1	
Osteomyelitis, femur	4	550,000	4	
Osteomyelitis, metatarsals	5	1,000,000	4	1
Otitis externa	1	700,000	1	
Otitis media, acute	1	500,000	1	
Periarteritis nodosa	16	450,000	15	1
Peritonitis, general, acute	1	790,000		1
Pleurisy, suppurative	1	80,000		1
Pleurisy, serofibrinous	32	1,000,000	28	4
Pneumonia, broncho-	5	1,000,000	5	
Pneumonia, lobar	17	600,000	10	7
Pneumonitis, acute	9	700,000	7	2
Pneumonia, primary atypical	3	600,000	2	1
Pharyngitis	3	1,000,000	2	1
Sinusitis, maxillary	1	1,000,000		1
Sinusitis, frontal	9	200,000	9	
Pansinusitis	2	400,000	2	
Pyelitis	2	700,000	2	
Stomatitis	2	500,000	2	
Septicemia, streptococcic	2	450,000	1	1
Septicemia, hemolytic streptococcal	1	24,000		1
Septic sore throat	1	2,500,000	1	
Tuberculosis, pulmonary, acute, pneumonic	1	500,000		1
Ulcer, duodenum	1	300,000		1
Wound, infected	1	300,000		1
	12	500,000	10	2
	1,101		1,052	49

Successes—96 per cent.

CLINICAL NOTES

SUBACUTE BACTERIAL ENDOCARDITIS SUCCESSFULLY TREATED WITH PENICILLIN

FRANCIS W. PIZZI
Lieutenant Commander (MC) U.S.N.R.
and
FRANK W. McCARTHY
Lieutenant, junior grade (MC) U.S.N.

There have been several reports of attempts to treat subacute bacterial endocarditis with penicillin. The Floreys (1) found that one case improved during treatment but relapsed as soon as the drug was stopped. Schmidt and Sesler (2) believed that the failure they observed was due to the quality of penicillin fastness. Seventeen patients were treated by the Committee on Chemotherapeutic and Other Agents of the National Research Council (3). There were four deaths, 10 patients showed no effect, and of the 3 patients who improved temporarily, two relapsed with cessation of the drug. The committee therefore recommended that penicillin should not be used in subacute bacterial endocarditis.

Lyons (4) reported two cases of staphylococcus endocarditis which did not respond to the drug but were shown to have been penicillin fast. Loewe and his associates (5) reported seven cases successfully treated with heparin and penicillin. Five were *Streptococcus viridans* in type, one pneumococcus, and one *Streptococcus haemolyticus*. No bacterial or clinical evidence of the disease had appeared in 3 months. As yet, so far as we can determine, there have been no reported cases of success with penicillin alone.

Case report.—A girl of 8 years was admitted to the hospital on 15 March 1944 because of abdominal pain and vomiting of 12-hour duration. For the past year she had suffered from a series of upper respiratory infections and had been bothered by a constant severe cough. The only significant rheumatic history is one episode of joint pains in the knees for an undetermined length of time, but there had apparently been no dyspnea, palpitation, or inflammatory character to the arthritis. She also had anorexia, had gained no weight, and had occasional nosebleeds and frequent "stomach upsets" with fever.



A history of recurrent attacks of bronchitis with chills and fever every winter for the past 4 years seemed to be outweighed by the gastric complaints in the past year. The child's father and mother are living and well but the mother's sister died of rheumatic heart disease as a child of 14 years.

On admission the patient's temperature was 100.2° F., pulse rate 100, respirations 28, and blood pressure 100/70. The child was thin and pale, but in no acute distress. Her eyelids were mildly puffed. Vision was normal. There were many shotty cervical nodes. The heart was not enlarged to percussion; the rhythm and rate were normal, but a rather soft protodiastolic murmur was heard, particularly at the apex. Her lungs were clear to percussion and auscultation. There were no abdominal masses or skin manifestations. X-ray examination showed increased hilar density compatible with a chronic bronchitis, and a slightly hypertrophied heart with a mitral configuration.

An admission blood analysis showed a hemoglobin content of 78 percent and 11,800 leukocytes per cubic millimeter with a differential count of 63 polymorphonuclear leukocytes. The erythrocyte sedimentation rate was 20 mm. in 1 hour.

On 20 March a Pirquet's reaction was negative and sputum was examined for tubercle bacilli to no avail. Four days later there was no change in the erythrocyte sedimentation rate and the sputum was still negative. The white blood cell count was 15,000, and the red blood cell count 4,400,000. The heart murmur was more noticeable and prolonged. Three days later, on 27 March, the erythrocyte sedimentation rate was 12 mm. in one hour, the hemoglobin content 84 percent, and the white blood cell count 10,400.

The patient had her first chill on 29 March and the temperature rose to 104° F. Urinalysis showed gross hematuria with no casts. The blood pres-

sure dropped to 90/45 and rose no higher at any time. She was started on a fluid diet and alkalizing drugs. Her temperature dropped and she seemed to be improving. On 30 March the temperature rose to 106° F. A clysis of 1,000 cc. of normal saline was given. There was still the impression that this was a nephritic episode because there had been no previous evidence of endocarditis. There was no splenic tenderness and no petechiae were evident. The patient's face was pale and sallow. The spiking temperature continuing, a bacteriemia was obvious and a clinical diagnosis of subacute endocarditis was probable.

Petechiae were first observed in the conjunctivae on 31 March and the spleen became palpable and tender. The temperature remained elevated for 4 days. On 1 April the patient received a transfusion of 350 cc. of whole blood but there was no subsidence of symptoms. The first dose of penicillin was given as 4 cc. intramuscularly and continued as a dosage of 4 cc. every 4 hours, or 20,000 Oxford units for 5 doses, then 3 cc. or 15,000 units for 2 doses, followed by 2 cc. or 10,000 units every 4 hours for 7 days following remission of fever.

The course was uneventful as the petechiae cleared. The urine showed fewer red cells, the patient looked better and the edema was subsiding. On 5 April the first blood culture was taken with medium secured from the Philadelphia Naval Hospital.

The heart murmur had taken on a rougher and more prolonged note, but there was no presystolic element. For the next 3 days a to-and-fro murmur could be heard at the apex. The penicillin was stopped as the available supply of the drug was exhausted, and 40 hours later, following a severe chill, the temperature again rose to 104° F. The previous blood culture now showed the *Streptococcus viridans*.

On 11 April another blood culture was made, another transfusion of 400 cc. of whole blood was given and penicillin was restarted by the intravenous route, giving 15,000 units as the initial dose and 5,000 units intravenously every hour for the first 24 hours, and then switching to the intramuscular route. One hundred thousand units were administered daily for 5 days through 16 April. At this time the dosage was cut in half, as the supply became uncertain, and this reduced dosage was maintained for 9 days.

On 18 April the blood culture showed *Streptococcus viridans*. With routine therapy the patient's blood components reached a level of 4,150,000 red blood cells, 11,100 white blood cells and a hemoglobin content of 80 percent. The urine cleared up 1 week after each episode of fever.

Following her discharge the patient has had one blood culture, taken on 18 May, which was negative. The heart murmur remains as a soft blowing systolic murmur replacing the first sound at the apex. One week after discharge the red blood cell count was 4,350,000, white blood cell count 9,000, hemoglobin content 86 percent, and blood sedimentation rate 12 mm. in 1 hour.

REFERENCES

1. FLOREY, M. E., and FLOREY, H. W.: General and local administration of penicillin. *Lancet* 1: 387-397, March 27, 1943.
2. SCHMIDT, L. H., and SESLER, C. L.: Development of resistance to penicillin by pneumococci. *Proc. Soc. Exper. Biol. & Med.* 52: 353-357, April 1943.

3. KEEFER, C. S.; BLAKE, F. G.; MARSHALL, E. K., JR.; LOCKWOOD, J. S.; and WOOD, W. B., JR.: Penicillin in treatment of infections; report of 500 cases; statement by Committee on Chemotherapeutic and Other Agents, Division of Medical Sciences, National Research Council. J.A.M.A. 122: 1217-1224, August 28, 1943.
4. LYONS, C.: Penicillin therapy of surgical infections in the U. S. Army. J.A.M.A. 123: 1007-1018, December 18, 1943.
5. LOEWE, L.; ROSENBLATT, P.; GREENE, H. J.; and RUSSELL, M.: Combined penicillin and heparin therapy of subacute bacterial endocarditis. J.A.M.A. 124: 144-149, January 15, 1944.



PROLONGATION OF PENICILLIN RETENTION BY PARA-AMINOHIPPURIC ACID

The very great rapidity with which penicillin is cleared from the blood stream and appears in urine is a major disadvantage in therapy, and suggests that it might be eliminated by renal tubular secretion in addition to glomerular filtration. If such were the case, it might be possible to suppress the secretion of penicillin by the simultaneous administration of p-aminohippuric acid (PAHA) which is known to be secreted by the tubular epithelium and which is found to be remarkably non-toxic.

Two-hour experiments using normal, unanesthetized trained dogs were designed in which 10,000 Oxford units of penicillin were injected intravenously as a single dose. In the control tests no PAHA was infused, but in other experiments intravenous PAHA infusion was started shortly before and carried out continuously during the experiments. These experiments demonstrated that PAHA markedly prolonged the maintenance of an elevated plasma concentration of penicillin. The recoveries of penicillin in the urine of one dog when no PAHA was administered were 61, 77 and 97.7 percent. When PAHA was administered intravenously only 29.6 to 36.6 percent of the penicillin injected was recovered in 2 hours.

Twelve-hour experiments, similar to those outlined above but during which the dogs were anesthetized, substantiated and extended the above findings.

These results indicate that with the aid of PAHA one may attain and maintain materially higher concentrations of penicillin in plasma than is practicable without the use of excessive amounts of penicillin. The ease and economy with which this can be accomplished experimentally suggest that the combined intravenous administration of penicillin and PAHA may offer sufficient therapeutic advantages to make its clinical trial indicated.—BEYER, K. H.; WOODWARD, R.; PETERS, L.; VERWEY, W. F.; and MATTIS, P. A.: Prolongation of penicillin retention in body by means of para-aminohippuric acid. *Science* 100: 107-108, August 4, 1944.

AGRANULOCYTOSIS TREATED WITH PENICILLIN

REPORT OF CASE

HOWARD B. SPRAGUE

Captain (MC) U.S.N.R.

and

L. KRAEER FERGUSON

Captain (MC) U.S.N.R.

Agranulocytosis, or agranulocytic angina, is defined by Jackson as "an acute, fulminating disease, characterized by an extreme leukopenia and neutropenia, accompanied by ulcerations of the mucous membranes, skin or gastro-intestinal tract, and, when untreated, leading to death in the great majority of cases." In untreated or inadequately treated disease the mortality is approximately 76 percent. In cases treated with pentnucleotide it has been reported as 35 percent.

In many instances secondary sepsis is the lethal factor and for that reason agents to control infection are indicated in the therapy of the disease. In the case reported here penicillin was the agent used to combat infection, and in our opinion was responsible for the patient's recovery by preventing overwhelming toxemia during the return of function of the hematopoietic system.

Case report.—The patient, a seaman, first class, 22 years old, was admitted to the hospital on 3 January 1944 with the complaints of sore throat, prostration, and fever which had begun suddenly about two days before and had increased rapidly in severity.

Six months before the present illness, he had been treated for 6 weeks with a sulfa drug for gonorrhea. When the urethral discharge ceased the drug was stopped. During the week previous to admission (seven months later), the urethral discharge had returned and the patient had been given sulfathiazole at another activity, in the dosage of 1 gm. every 4 hours for 6 days.

On admission the patient was acutely ill; his color was poor and he was stuporous. The pulse rate was 130, temperature 104.8° F., and respirations 40. There was a frequent, dry cough. The pharynx was markedly infected and granular, and the uvula edematous. The tonsils were inflamed and covered with small, necrotic, grayish, membranous deposits. The heart, lungs, and abdomen showed no abnormalities. There was a firm, painful, swollen lymph node in the left axilla. There was no lymphangitis of the left arm but there was a round, infected lesion, 1 cm. in diameter, on the palm of the hand at the base of the second finger. Slight tenderness and swelling were present in the left groin and there was a small infected lesion of the skin in the region of the left costovertebral angle. A small cluster of herpes was found on the right forearm in the region of the wrist.

The urine was negative. The leukocyte count was 900 per cu. mm. on admission, falling to 275 two days later and gradually rising to 1,640, with 44 percent polymorphonuclear leukocytes on 13 January; 5,800, with 77 percent polymorphonuclear leukocytes on 17 January; and 8,850 on 20 January. The erythrocyte count showed a variable reduction of red cells to 2,300,000. The hemoglobin content at its lowest was 9.5 gm. The differential count on admission showed 92 percent lymphocytes, 4 percent segmented forms, and 4 percent mononuclears. Much of the time the anemia was very mild. Kahn and blood culture were negative. Throat culture on admission showed a nearly pure culture of *Staphylococcus aureus*. Electrocardiographic findings were within normal limits.

The patient remained severely ill for several weeks. During this time the presenting signs were high septic fever, disorientation, ulcerations of the throat and of the skin of the feet, purpuric eruptions, jaundice, and recurring massive abscesses of the inner sides of both thighs, of both feet, the face, an area below the inferior angle of the right scapula, in the left axilla, the right side of the neck, below the left clavicle, and in the subpectoral region. Upon the return of leukocyte production, pus rapidly accumulated in these abscesses. On several occasions large abscesses formed overnight and appeared without any preceding symptoms. Surgical drainage was resorted to on three occasions; in other instances the abscesses drained spontaneously. Skin grafts were applied to the lesions on the legs on 22 March.

Specific therapy for agranulocytosis is still rather empirical but the following methods were utilized.

The patient received immediate transfusions of whole citrated blood and 250 cc. twice a day for a period of 11 days. After this 14 more transfusions were given up to 25 March. Pentnucleotide, 10 cc. intramuscularly, was administered every 6 hours beginning 5 January and discontinued on 19 January. Yellow bone marrow was given for several days beginning 6 January. Administration of liver extract was started on 7 January with an intramuscular dose of 3 cc. daily, and was stopped on 19 January.

Penicillin therapy was started at once, 20,000 units being administered every 4 hours intramuscularly. It was discontinued for 5 days on 15 February but upon recurrence of septic phenomena and the reappearance of massive abscesses was again employed. Its use was stopped on 3 March after a total dosage of approximately 6,480,000 units.

SUMMARY

The case here reported apparently is typical of agranulocytosis precipitated by sensitivity to sulfathiazole. The course of the disease was characteristic of a severe attack in which leukopenia was marked, the number of white blood cells falling to 275 per cu. mm. By 20 January the purpura and jaundice had cleared, the temperature was normal, and the blood studies showed 8,850 white cells with 52 percent lymphocytes, 10 percent band forms, 24 percent segmented forms, and 14 percent mononuclears.

It is our belief that recovery of this patient was the result of combined medical and surgical treatment. The response of the hematopoietic system to transfusions, pentnucleotide, yellow bone

marrow, and liver extract appears to have been adequate to restore the blood to normal, but it is our opinion that, without adequate surgical drainage of the abscesses, suture of the wounds and skin-grafting, the toxemia would have overwhelmed the patient.

The role of penicillin would appear to have been that of preventing generalized sepsis and septicemia. It did not prevent the appearance of localized abscesses, but clinical experience indicates that a patient presenting such extensive local processes would, in all probability, have succumbed to septicemia had the infection not been held in check. For this reason, it would seem advisable to administer penicillin to patients with agranulocytosis in addition to the orthodox methods for stimulation of leukocyte production.



PENICILLIN IN ACNE

The value of penicillin in this condition remains uncertain. The acne bacillus is resistant to penicillin, and the response of the disease to treatment will depend presumably on the extent to which staphylococci are accountable for the suppuration in each particular case.—ROXBURGH, I. A.; CHRISTIE, R. V.; and ROXBURGH, A. C.: Penicillin treatment of certain diseases of skin. *Brit. M. J.* 1: 524-528, April 15, 1944.



PARENTERAL PENICILLIN IN SPINAL FLUID

Penicillin was administered in doses of 20,000-40,000 Oxford units intravenously or intramuscularly to 8 subjects with meningitis. Sixty to 140 minutes later penicillin was found in the spinal fluid in concentrations of 0.03 to 0.35 unit per cc.

These data suggest that penicillin administered intravenously or intramuscularly in adequate dosages may be effective in the treatment of meningitis without supplementary intrathecal therapy.—ROSENBERG, D. H., and SYLVESTER, J. C.: Excretion of penicillin in spinal fluid in meningitis. *Science* 100: 132-133, August 11, 1944.

PENICILLIN IN MALIGNANT GRANULOCYTOPENIA

REPORT OF CASE

WILLIAM C. MEREDITH

Lieutenant Commander (MC) U.S.N.R.

ALBERT H. R. DOUGLAS

Lieutenant Commander (MC) U.S.N.R.

and

HAROLD FINK

Lieutenant Commander (MC) U.S.N.R.

The high mortality rate in malignant granulocytopenia, in spite of intensive efforts to stimulate the bone marrow, has resulted in continued attempts to find a new approach to the problem. Chemotherapy^{1,2} has offered encouragement. With this in mind, a recent case of granulocytopenia at this hospital was treated with penicillin; this therapy was in addition to the usual measures aimed at effecting a normal myeloid function.

Case report.—The patient, a white 24-year-old gunner's mate, second class, experienced difficulty in swallowing, particularly hot liquids, on 14 February 1944. Mistaking the condition for a cold, he took 12 tablets of sulfathiazole during the day. The next day his throat was definitely sore and that evening he had chills followed by fever. The following morning his temperature was still elevated and he was admitted to the hospital.

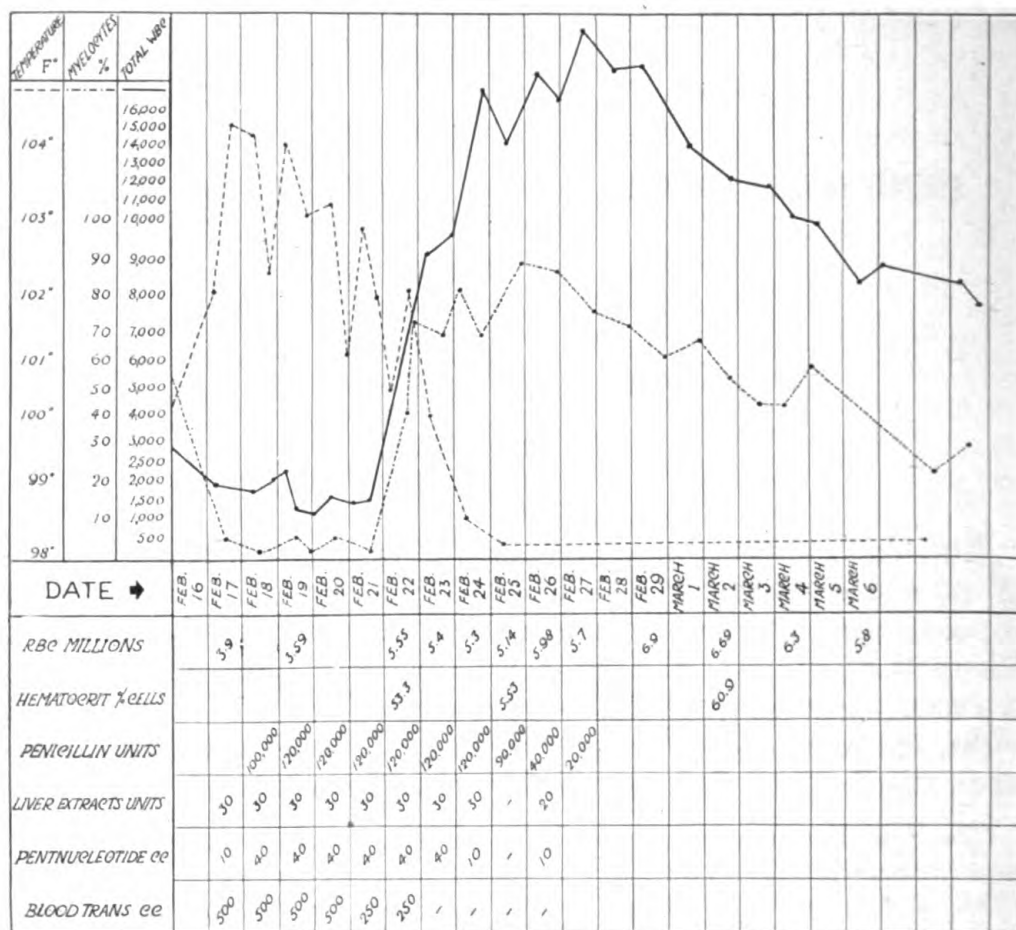
Two months previously he had been ill for about one week with similar symptoms followed by jaundice. He did not seek medical attention but took a total of 32 tablets (16 gm.) of sulfathiazole during the course of his illness. In 1941 he had been uneventfully treated with sulfathiazole for gonorrhea and since that time had frequently taken smaller amounts for minor infections and venereal prophylaxis.

Examination upon admission revealed him to be moderately ill, with a temperature of 100.4° F., pulse rate of 120, and respirations 23 per minute. There was mild congestion of the pharynx and two small nodes were palpable in the right axilla. There were no other significant findings, and all the laboratory studies were negative except for a leukocyte count of 2,700, with a differential count of 56 percent polymorphonuclear leukocytes, 40 percent lymphocytes, 3 percent monocytes, and 1 percent eosinophils. X-rays of the chest and esophagus were within normal limits. The patient was considered to be suffering from an influenzal type of upper respiratory tract infection.

On the following day his temperature rose to 104.4° F. with a coincidental

¹ NIXON, N.; ECKERT, J. F.; and HOLMES, K. B.: Treatment of agranulocytosis with sulfadiazine. *Am. J. M. Sc.* 206: 713, December 1943.

² DAMESHEK, W., and WOLFSON, L. E.: Preliminary report on treatment of agranulocytosis with sulfathiazole. *Am. J. M. Sc.* 203: 819-823, June 1942.



fall in the white blood cell count to 1,600, with 100 percent lymphocytes. His dysphagia had become much more marked and there was now a tender lymph node the size of an almond palpable in the deep cervical glands on the right side of the neck, and brawny induration of the entire right side. For 6 days the hospital course was stormy, with the temperature varying between 100° and 104.2° F., and the white blood cell count never exceeding 2,400 with 4 percent myeloid cells.

Two days after admission, when the diagnosis of malignant granulocytopenia had been established, intensive therapy was immediately instituted; this consisted of transfusions of whole blood, intramuscular injections of liver extract, and injections of pentnucleotide, with, in addition, penicillin. This was administered in quantities of 100,000 units for the initial dose and 120,000 units for the following 6 days, decreased to 90,000, 40,000 and 20,000 units on the next 3 days, and was discontinued on the eleventh day. This is shown on the accompanying chart.

Ten days after admission the temperature became normal, significant numbers of polymorphonuclear cells had reappeared in the circulating blood, and the inflammatory condition in the neck had improved markedly. From this time on the patient rapidly regained his strength and his convalescence was uneventful (see chart). During a period of 10 days the patient had received 2,500 cc. of whole blood, 260 units of liver extract, 270 cc. of pentnucleotide, and 970,000 Oxford units of penicillin.

SUMMARY

The increasing use of the sulfonamides can be expected to result in a corresponding increase in the incidence of their toxic manifestations, including granulocytopenia. The search for any form of therapy which will decrease the mortality in this condition, either by augmenting or supplanting the present procedures, is unceasing. This case is presented to add to the information being accumulated in the study of penicillin, with particular reference to its use in malignant granulocytopenia.



REACTION FROM PENICILLIN

Local irritation at the site of injection of either the sodium or the calcium salt of penicillin varies with different batches. Changing the site of administration or changing the product often will terminate this reaction. The only other toxic reaction of any significance is the occurrence of urticaria and irritative dermatitis. The latter reaction is very infrequently seen. Febrile reactions may occur if the penicillin employed is not pyrogen free.—HERRELL, W. E.; NICHOLS, D. R.; and HEILMAN, D. H.: Penicillin; its usefulness, limitations, diffusion and detection, with analysis of 150 cases in which it was employed. J. A. M. A. 125: 1003-1011, August 12, 1944.



PENICILLIN AND SMALLPOX

Four patients with confluent smallpox were treated, at the height of eruption, with penicillin. The pustules contained *Staphylococcus aureus* in abundance. Three patients survived, including one who had never been vaccinated.

They were given a systemic course of sodium penicillin, 15,000 units intramuscularly every three hours, for 3-4 days (average 400,000 units). In the 3 that recovered there was a pronounced improvement in general condition within 24 hours, and the quick drying of the pustules and subsequent minimal pock-marking was quite striking. Cultures from the pustules were reduced to 2-3 colonies or no growth.—JEANS, W. D.; JEFFREY, J. S.; and GUNDERS, K.: Penicillin and smallpox; report of four cases. Lancet 2: 44-45, July 8, 1944.

PENICILLIN IN TREATMENT OF HUMAN BITE INFECTIONS

REPORT OF TWO CASES

C. JOSEPH DELANEY
Commander (MC) U.S.N.R.

Injury to the hand by human teeth has always been a serious problem to the surgeon. As in other conditions for which there is no specific treatment many things have been advised, tried, and discarded. Simple incision and drainage in most cases was of no value and many times led to a false sense of security while the infection spread rapidly. Wide excision gave the best results, but the radical extent of the operation many times led to the loss of a finger or hand before the infection was controlled. The fascial ramifications in this area is a factor in the insidious character of the infection's spread.

The numerous bacteria found in these cases led to the use of many chemical bactericidal agents. At one time it was routine to give arsphenamine on the basis of the presence of mouth spirillum. Local use of arsphenamine after excision was also recommended. Meleney's work led to the application of zinc peroxide following cauterization of the devitalized tissue. The sulfonamides have been used both locally and parenterally. All these methods left much to be desired in their end-result. The two cases of human bite of the hand presented here were treated successfully by penicillin.

CASE REPORTS

Case 1.—A white male was admitted to the hospital complaining of a swollen, painful right hand. He stated that 3 weeks previously he had engaged in a struggle with a civilian who was making disparaging remarks about the Navy. As a result he suffered a laceration of the skin of the first joint of the right index finger caused by his opponent's teeth. His history was not otherwise pertinent to the case.

Examination of the right hand revealed marked swelling and edema extending to the wrist. The fingers were puffy. Erythema of about 8 cm. in diameter extended over the dorsum of the hand, in the center of which was a transverse laceration 1.5 cm. in length over the second metacarpophalangeal joint. Exuding from the wound was a fairly thin, brownish gray purulent malodorous material. Tenderness was not marked and the patient did not complain of any great degree of pain. The accompanying illustration (fig. 1) reveals the extent of the lesion.



1. Case 1. Appearance on admission.



2. Case 1. Appearance five days after penicillin therapy was started.

X-ray study revealed no bony involvement. Culture of the wound showed the presence of a few unidentified diphtheroids, staphylococci, and β -hemolytic streptococci. No darkfield examination was made. The blood culture and Kahn were negative. Blood studies, including those for plasma protein, chlorides, and blood urea nitrogen were within normal limits. Complete blood count revealed 5,200,000 erythrocytes and 17,150 leukocytes, with a differential of 54 percent mature cells and 39 percent lymphocytes.

Excision of the devitalized tissue at this time would have had to be extensive. Excision followed by penicillin therapy was considered, but it was finally decided to try penicillin therapy alone. It was started immediately in the dosage of 100,000 units per day intravenously, for 2 days and 100,000 units per day intramuscularly for 8 days. This course was completed in 10 days. Within 48 hours after beginning treatment the discharge from the wound had ceased and the swelling and redness began to subside. At the end of 5 days the hand was nearly well (fig. 2). However, treatment was continued for 5 more days, and the patient was discharged cured. At no time during the course of treatment was the temperature above 100.4° F. and usually was between normal and 99.6° F. The pulse rate was within normal limits.

Case 2.—A white male was admitted to the hospital with the history of having suffered a laceration of the fourth knuckle of the right hand following contact with human teeth. An x-ray taken by a local physician revealed a fracture of the head of the fourth metacarpal bone, and the physician cleaned and sutured the laceration. Drainage began 2 days later, and oral administration of sulfathiazole, 15 gm. three times a day, was started after removing the sutures. Drainage continued and the hand became swollen and red, especially on the dorsal surface. There had been no fever. There was pain on movement of the fingers, most marked on extension, particularly of the fourth finger.

Examination of the hand revealed a small irregular laceration on the dorsum over the fourth metacarpophalangeal joint. A thin seropurulent material was draining from the wound. There was considerable swelling and redness of the whole hand, especially over the dorsum around the laceration. There was pain on extensive activity of the fourth finger, but no pain when it was moved passively. There was no axillary or epitrochlear adenopathy.

X-ray examination revealed an oblique fracture through the distal articulating surface of the fourth metacarpal bone. Position and alignment were excellent, and no evidence of bone disease was noted. Culture of the wound on blood agar showed hemolytic staphylococci. Blood culture was negative. The blood count showed 4,810,000 erythrocytes and 13,700 leukocytes, with 73 percent mature cells and 22 percent lymphocytes.

In view of the previous good result with penicillin alone, no surgery was performed and penicillin therapy was begun immediately. One hundred thousand units was administered daily for 2 days by the intravenous route, followed by 8 days of 100,000 units daily intramuscularly, making a total dosage of 1,000,000 units.

Within seven days drainage from the wound had ceased and the swelling had decreased. Three days later the hand was healed and motion was almost complete with no pain and no swelling, and the patient was returned to duty well.

These two cases are reported as a matter of academic interest.

Both patients were discharged cured after 10 days of penicillin therapy. No claim is made that penicillin is a specific cure for human bite infections. The organisms sensitive and resistant to that drug are becoming fairly well catalogued. In fact penicillin therapy should lead to a keener interest in selectivity in wound bacteriology. Some institutions test all organisms for their sensitivity to penicillin in various dilutions before treatment is begun. Fortunately in these two cases the bacteria found were not resistant to the drug.



PENICILLIN EFFECTS ON ANAEROBES

In vitro, penicillin is a powerful inhibitor of the gas-gangrene anaerobes. With infections caused by *Cl. welchii* one injection of 34 Oxford units proved sufficient to save the majority of the treated animals, but when injection was withheld for three or six hours the animals died although the time of death was delayed. Penicillin proved much superior to propamidine, proflavine, or the sulfonamides in the treatment of *Cl. welchii* infections, and was also found more effective than these agents, although the margin of superiority was much smaller, against *Cl. oedematiens* infections. In the case of infections caused by *Cl. septique*, however, sulfathiazole yielded the more favorable results. On the basis of these observations it was suggested that for clinical prophylaxis a mixture of sulfathiazole and penicillin would be likely to prove the most effective combination.—Brochure. Penicillin. Compiled by Editorial Staff, Merck & Co., Inc., Rahway, N. J., June 1944. pp. 33-35.



MORPHOLOGIC CHANGES INDUCED BY PENICILLIN

Penicillin in subinhibitory dilutions causes morphological changes in certain bacteria. It was observed that cultures of *Clostridium welchii* growing in a fluid medium containing penicillin of less than full inhibiting power manifested a flocculent growth with a heavy deposit instead of the more uniform turbidity. Microscopic examination of such cultures revealed "an extreme elongation of the majority of the cells, which took the form of unsegmented filaments ten or more times longer than the average normal cell." More extensive investigation showed that this phenomenon is common to all the rod-shaped organisms that show any degree of inhibition, particularly the gram-negative organisms.—Brochure. Penicillin. Compiled by Editorial Staff, Merck & Co., Inc., Rahway, N. J., June 1944. pp. 18-19.

CEREBROSPINAL FEVER TREATED WITH CISTERNAL ADMINISTRATION OF PENICILLIN

REPORT OF CASE

L. TATE MILLER

Commander (MC) U.S.N.R.

and

CLARENCE W. ROSS

Captain (MC) U.S.N.

A patient critically ill with cerebrospinal fever which proved resistant to sulfadiazine and to the intraspinal and intramuscular administration of penicillin, responded well following drainage of fibrinopurulent material from the cisterna magna and administration of penicillin cisternally.

Case report.—A seaman, second class, was admitted to this hospital from leave status on 5 March 1944 in a comatose condition. The patient's history obtained from his brother indicated that the patient's symptoms had begun 5 days previously as severe pains in the legs and back associated with severe headache. He apparently was comatose on the next 2 days but was thought to be drunk. He was seen by a civilian physician on 3 and 4 March and as he was still unconscious he was brought to the Naval hospital.

On arrival here he was in deep coma and badly dehydrated. There was marked rigidity of the neck, back, and legs, and Kernig's sign was positive. The temperature was 97° F., pulse rate 80, respirations 22, and blood pressure 120/80.

Spinal tap yielded a very cloudy fluid under increased pressure. The fluid showed innumerable white blood cells, 70 percent polymorphonuclear leukocytes, and gram-negative intracellular diplococci. Repeated cultures of the spinal fluid yielded negative results. Blood count showed 22,000 leukocytes with a differential of 95 percent polymorphonuclear leukocytes and 5 percent lymphocytes. The urine was negative.

Five grams of sodium sulfadiazine intravenously and 2 gm. by nasal tube were administered every 4 hours, and sodium pentobarbital (3 grains) was given as needed. On the day following admission the patient was still comatose. The blood level of sulfadiazine was 3.9. The following day administration of penicillin, 10,000 units intrathecally every 10 hours and 20,000 units intramuscularly every 3 hours, was begun and sulfadiazine was continued. Intravenous administration of penicillin proved impossible because of inability to keep the needles in the veins. Nutrition and fluids were maintained by intravenous dextrose and nasal tube for 6 days.

Treatment was continued, but no improvement was noted on the fourth hospital day and administration of oxygen was instituted because of increasingly labored respiration, cyanosis, and profound weakness. The patient's temperature was 102° F. On the following day there was still no improve-

ment, the patient's condition was believed to be critical, and a spinal block was considered. A cisternal puncture was done. At first there was no return of fluid but on slight suction 2 cc. of thick fibrinopurulent material was recovered followed by a cloudy spinal fluid. Ten thousand units of penicillin was injected into the cisterna magna. Later in the day the patient mumbled something and opened his eyes for the first time. He seemed to improve from that time.

Cisternal puncture was repeated on the following day and 2 cc. of fibrinopurulent material was recovered and penicillin was again administered cisternally. The patient was now markedly improved, conscious, and rational at times. On the next day improvement continued and the nasal tubes for oxygen and feeding were removed and penicillin was discontinued. At this time the blood sulfadiazine level was 8.3.

On 13 March, 8 days after admission, there was further marked improvement although the patient still had some chest pain, a rather active diarrhea (adult male ascaris was passed on the seventh day), and a continued nuchal rigidity. He was still receiving sulfadiazine. The diagnosis was changed from the provisional one of meningitis to that of cerebrospinal fever, meningococcic. Since then the patient's convalescence has been rapid and uneventful except for the development of tinnitus and eighth nerve deafness, as was anticipated by the neural surgeon. Repeated search for ascarides or ova has been unavailing.

In infections of the meninges, especially when early treatment has been neglected, failure of the patient to improve after accepted forms of treatment should always suggest the possibility of spinal block. If this condition is believed to exist, the necessity for a more direct attack on the infection becomes obvious. Usually the cisterna magna should be the first point to which the attack is directed. In other circumstances, or following failure to obtain satisfactory results by the cisternal route, puncture and drainage of the lateral ventricle followed by injections of penicillin should be considered.



PENICILLIN IN IMPETIGO

Twelve cases of impetigo were treated by removal of crusts followed by local application of sodium or calcium penicillin in the lanette wax and petroleum jelly base, 400 units per g.

Of the 12 cases treated 11 were completely cured. The important factor is the time required to produce this result: on an average this was 8 to 9 days. Most of these patients, however, were in a fairly advanced condition when treatment was started, and as ointment was applied only in the immediate neighborhood of the lesions it was difficult to prevent spread to unaffected areas. Individual lesions under treatment healed in about 4 days.—ROXBURGH, I. A.; CHRISTIE, R. V.; and ROXBURGH, A. C.: Penicillin treatment of certain diseases of skin. *Brit. M. J.* 1: 524-528, April 15, 1944

YAWS TREATED WITH PENICILLIN

REPORT OF CASE

ROBERT C. LOFGREN

Lieutenant Commander (MC) U.S.N.R.

Penicillin has been shown to be valuable in treating syphilis.^{1,2} Because of the controversial relationship between syphilis and yaws it was decided to determine the effect of penicillin on the latter. The drug was found to be rapidly effective in the treatment of a case of yaws.

Case report.—A white ship's cook, second class, 20 years of age, was seen on 18 April 1944. He had had an ulcer on the right forearm for 3 months and a generalized eruption of the body for 2 weeks. He had burned his right forearm while on duty in American Samoa about 3 months previously. He stated that the burn became an oozing sore, partially healed, and then formed a small ulcer which gradually grew larger. He admitted having visited native huts and having held small naked children in his arms during the period when the burn was present. He did not remember having seen any sores on these children.

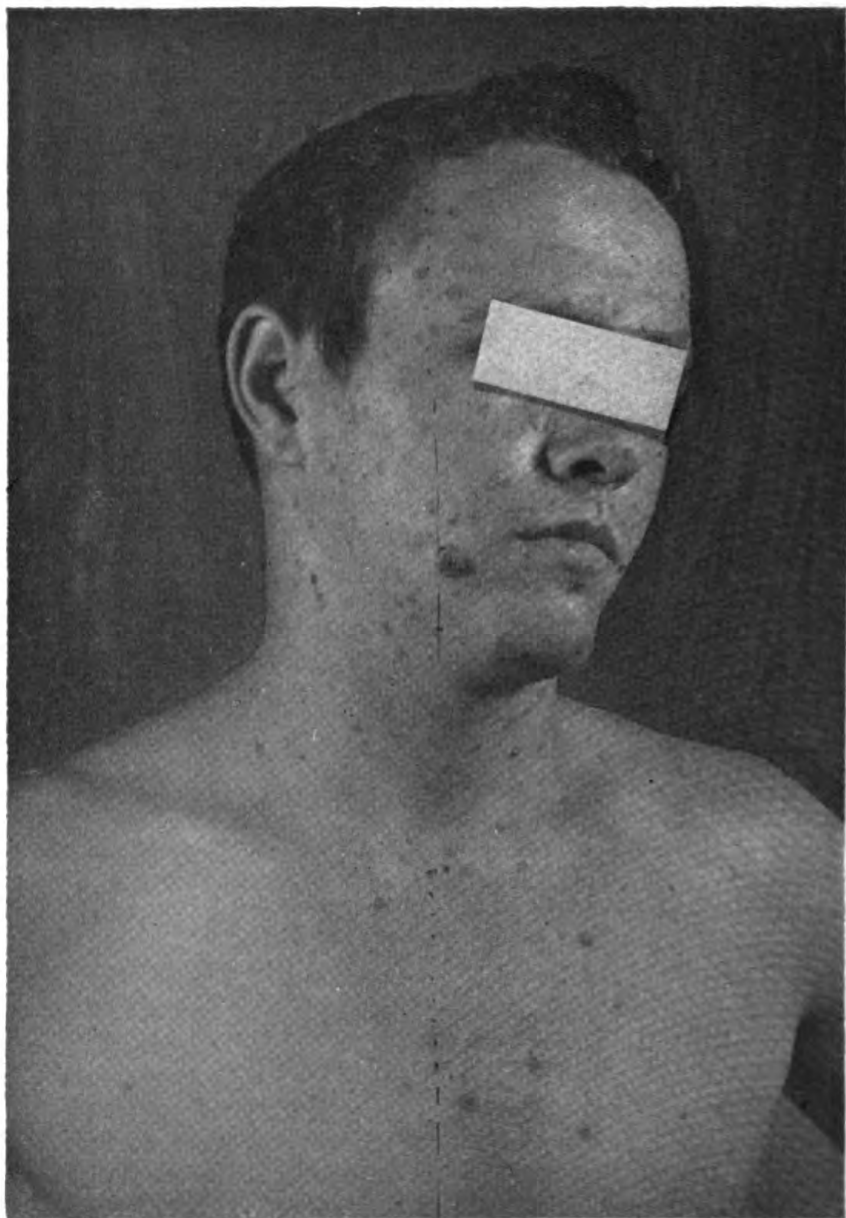
He arrived in the United States on 7 March and went home on a 30-day leave. While he was on board ship and while at home the original lesion was treated as a simple ulcer with boric acid ointment and "Swedish salve," but despite this treatment it continued to enlarge. On about 4 April he noticed the appearance of a "red pimple" on the right cheek. This gradually enlarged, became pustular, and then was covered by a yellow crust. One week after the appearance of the lesion on the cheek, similar lesions appeared on the rest of the face, the arms, chest, back, legs, penis, scalp, and hands. At no time were any subjective symptoms experienced.

The patient gave a history of having contracted gonorrhea in September 1942 while in British Samoa. His treatment consisted of 1 gm. of sulfathiazole orally four times daily and potassium permanganate (1:8,000) as daily urethral irrigations. He was discharged as fit for duty after having been hospitalized for 15 days. He denied having any penile sores at this time or at any time before the onset of his present trouble. His blood Kahn was negative at the time of his induction into the Navy on 27 February 1942.

Physical examination revealed a generalized erythematous papular and pustular eruption involving the extremities, face, trunk, scalp, hands, feet, penis and scrotum. Many lesions were crusted and scaling, apparently in various stages of resolution. The eruption showed a marked resemblance to variola. The papules and pustules involved the palms and soles. Many of the papules had pitted centers on sites apparently previously occupied by crusts

¹ MAHONEY, J. F.; ARNOLD, R. C.; and HARRIS, A.: Penicillin treatment of early syphilis; preliminary report. *Am. J. Pub. Health* 33: 1387, December 1943.

² O'LEARY, P. A., and HERRELL, W. E.; Penicillin in treatment of late cutaneous syphilis; report of case. *Proc. Staff Meet., Mayo Clin.* 19: 20, January 12, 1944.



1. Appearance of generalized yaws lesions before the beginning of penicillin therapy.

that had become dried and fallen off. There was a dime-size **granulomatous** nodule on the right cheek just lateral to the corner of the mouth. This nodule had an erythematous periphery and was covered by a yellow-brown crust. When the crust was removed a reddish oozing base was exposed which resembled a raspberry (fig. 1).

There was an ulcer about the size of a half-dollar on the midflexor aspect of the right forearm. The edge of the ulcer was erythematous-livid in appearance and was slightly elevated. The base of the ulcer was **granulomatous**, slightly uneven, and was covered with a serosanguineous-purulent exudate. The base was elevated slightly above the level of the surrounding skin (fig. 2).



2. Primary yaw ulcer of right forearm of 3-month's duration before the beginning of penicillin therapy.

There were a few erythematous erosions and papules on the ventral aspect of the shaft of the penis and on the glans and foreskin. There were no lesions on the scrotum. The visible mucous membranes were normal in appearance. The tonsils were moderately large. The teeth and the nasal septum were normal. The epitrochlear, axillary, inguinal, femoral and posterior cervical lymph nodes were enlarged bilaterally. Examination of the bones, joints, heart, lungs, abdomen and central nervous system revealed no other abnormalities.

Darkfield examinations of serum taken from the ulcer of the right forearm, from the granulomatous nodule of the right cheek, and from four different early papulopustular lesions of the face selected at random, all revealed spirochetes which were morphologically typical of *Treponema pertenue* (*Spirochaeta pertenuis*). A diagnosis of yaws was made and the patient was hospitalized for treatment.

Upon the patient's admission to the hospital on 19 April, the blood Kahn test was 4-plus. Urinalysis was normal except for 20 to 25 white blood cells per highpower field. Complete blood count revealed 4,290,000 red blood cells, 85 percent hemoglobin, 4,050 white blood cells, with a differential count of 54 percent segmented neutrophils, 42 percent lymphocytes and 4 percent eosinophils. Spinal fluid examination done on 22 April, showed no cells, a total protein of 32 mg. percent, negative Kahn reaction, and a normal colloidal gold curve.

Treatment and course.—It was decided to test the therapeutic effect of penicillin³ in this case. Accordingly, on 22 April, 20,000 Oxford units of

³ A solution of penicillin containing 5,000 units per cubic centimeter was prepared by dissolving 100,000 units of the sodium salt of penicillin in 20 cc. of sterile triple-distilled water.

penicillin were given intravenously and immediately afterward 15,000 units intramuscularly. Thereafter 15,000 units were given intramuscularly every 3 hours until a total of 1,500,000 units had been given over a period of 12 days.

In order to determine how long it took to render yaws lesions darkfield-negative, serum obtained from the large lesion on the right cheek at 4, 8, 18, and 24 hours after the institution of treatment was examined for spirochetes by darkfield illumination.

Four hours after treatment was begun all lesions showed a definite peripheral erythema and were more prominent. Even the lesions that appeared to have been drying up had become erythematous. It was apparent that the patient was having a local shock reaction similar to a Herxheimer reaction in syphilis. Darkfield examination at this time showed 2 to 4 spirochetes per oil-immersion field. The patient had no complaints and his temperature was normal.

Eight hours after starting treatment, the lesions had become still more prominent and erythematous. In many places, and especially on the face, there were now erythematous macules where previously no lesions were visible. Pustules and crusting were more marked. The patient commented that his hands, which were the site of many lesions, were harder to close. The conjunctivae were slightly injected. Darkfield examination of material from the cheek lesion at the eighth hour of treatment still showed 2 to 4 spirochetes per oil-immersion field.

Eighteen hours after the beginning of treatment darkfield examination of serum from the cheek lesion was negative for *Treponema pertenue*. By this time the erythematous blush about the lesions had disappeared and the lesions were less prominent. Many crusts had fallen off. The lesion of the right cheek was smaller and the hands closed easily. The conjunctivae were no longer injected. The papules and pustules of the palms, however, were still prominent.

Darkfield examination of serum from the cheek lesion 24 hours after the beginning of treatment remained negative for spirochetes. During the next 2 days all lesions proceeded to involute rapidly, the crusts dropping off and the lesions scaling and disappearing from sight or leaving only slight pigmentary remains. By the fifth day of treatment the large yaw of the cheek was entirely healed as were all the smaller lesions. The ulcer of the right forearm, which had been receiving only topical saline wet compresses, was dry and almost healed, and local treatment was discontinued.

By the twelfth day 1,500,000 units of penicillin had been given and treatment was discontinued. The crust sloughed from the ulcer of the right arm on the thirteenth day, revealing a freshly healed scar. All lesions were healed at this time. The patient had no complaints. His temperature had been checked every 3 hours during the course of treatment and had remained normal throughout. Blood Kahn tests done on 24 April and 1 May were both four-plus. A complete blood count on 24 April was normal except for 6-percent eosinophils. The blood Kahn reaction was four-plus on 22 May, the day of discharge from the hospital, and one-plus on 29 May. On 6 June and again on 9 June results of blood Kahn tests were negative.

The diagnosis of yaws in the case presented would have been made early if yaws had been suspected and darkfield examinations for *Treponema pertenue* had been done on the ulcer scrapings.

All patients with chronic ulcers or with other persistent undiagnosed pustules or crusted lesions, who are on duty in districts where yaws is endemic, or who have recently returned from these areas, should be examined for the possibility of yaws. This can be done easily by darkfield examinations and by routine serologic tests.

The use of penicillin in the treatment of this case resulted in a very rapid resolution of all lesions. The patient had a typical local shock reaction and spirochetes could not be demonstrated in the yaws lesions 18 hours after treatment was begun. All lesions except the ulcer were healed in 5 days, and the ulcer itself in 13 days. These results are of particular interest because of the previously reported therapeutic effect of penicillin in the treatment of syphilis and because of the similarity between (or identity of) these two diseases.

The knowledge as to whether this patient is actually cured will depend upon a prolonged follow-up. Possible danger of ill effects for the patient in case of a poor therapeutic result was considered before treatment was begun. Since yaws is a relatively less serious disease than syphilis, and since 1,200,000 units of penicillin produced gratifying results in the treatment of early syphilitics, it was believed safe to give 1,500,000 units to this patient. If a relapse does occur, it will doubtless be a cutaneous or osseous one. Most yaws in the South Pacific island natives is inadequately treated, with many of the natives lapsing from treatment as soon as the skin lesions are cleared. In spite of this fact, it is exceptionally rare to see any central nervous system or cardiovascular involvement in these cases (and even these cases are considered doubtful).

When the result obtained in this case is compared with the time required for resolution in cases of yaws in natives in the South Pacific treated with mapharsen and bismuth, the apparently more rapid resolution of the yaws lesions when penicillin was used is impressive.

SUMMARY

1. A case of generalized yaws in a white man is reported.
2. This patient was given a total of 1,500,000 units of penicillin in a 12-day period.
3. A typical local shock reaction occurred in and about all yaws lesions. This reaction was present 4 hours after treatment was started and had disappeared when the patient was seen 18 hours after the beginning of treatment.
4. The yaws lesion, which was darkfield positive for *Treponema*

pertenué at 4 and 8 hours after the introduction of penicillin administration, was darkfield negative 18 hours after treatment was begun.

5. All yaws lesions, except the large ulcer of the forearm, were healed within 5 days. The ulcer of the forearm was completely healed in 13 days.

6. The blood Kahn reaction was positive before treatment was begun and was still positive when the patient was discharged from the hospital after 5 weeks of treatment, becoming negative 1 week later.



TOXIC REACTIONS OF PENICILLIN

Toxic reactions following the administration of penicillin are extremely rare. Occasional chills with fever, or headache and flushing of the face have been reported. Urticarial eruptions have been observed. Thrombophlebitis at the site of injection has been described and pain along the course of the vein during injection of the material has been complained of by some patients. Repeated and prolonged courses of penicillin at varying intervals of time do not predispose to the production of toxic effects.—DAVISON, F. A.: Synopsis of Materia Medica, Toxicology, and Pharmacology. 3d edition. The C. V. Mosby Co., St. Louis, Mo., 1944. p. 665.



BACTERIAL INACTIVATION OF PENICILLIN

The ability of various bacteria to inactivate penicillin was determined by a modification of the Oxford Cup method.

Many of the common pathogens and non-pathogens were studied. Practically all of the pathogens including hemolytic streptococci, pneumococci, and staphylococci had no effect on the action of penicillin. Among the bacteria showing inactivation were coliform bacilli, aerobic spore-forming bacilli and certain *Shigellae*. All organisms were tested by a culture tube test method to determine their susceptibility to varying concentrations of penicillin. There was good correlation between destruction of penicillin and resistance to it by the bacteria studied. Most of the organisms unable to inactivate penicillin were susceptible to its action. Certain exceptions were encountered.

Preliminary work on the nature of the inactivator produced by bacteria points to a substance protein in nature probably an enzyme.—BONDI, A., JR., and DIETZ, C. C.: Destruction of penicillin by bacteria. Abstracted in J. Bact. 47: 426, May 1944.

PENICILLIN THERAPY IN GONORRHEA WITH ASSOCIATED UNDIAGNOSED EARLY SYPHILIS

JOSEPH F. RICCHIUTI
Lieutenant (MC) U.S.N.R.

Penicillin therapy is replacing sulfonamides in the treatment of gonorrhea in Naval hospitals. Since gonorrhea may be associated with syphilis contracted at the same exposure, an unusual problem in diagnosis and management may present itself.

Mahoney and his coworkers¹ have shown that the *Treponema pallidum* disappears from a previously darkfield-positive lesion after the sixteenth hour of penicillin therapy with approximately 60,000 to 80,000 units. A balanoposthitis or an unretractable prepuce may prevent a thorough examination of the glans, corona, frenulum, or urethral meatus for the presence of an initial lesion, unless a dorsal slit is made. The presence of a penile ulcer, generalized or local lymphadenopathy, balanoposthitis, intra-urethral nodule, or a suspected skin eruption contraindicates the use of penicillin until the diagnosis of syphilis is established or eliminated.

When a patient who has a concealed or unsuspected chancre has been receiving penicillin therapy for gonorrhea, the darkfield examination will yield a negative result upon discovery of the lesion and the patient may then have to await the later development of positive serologic tests for diagnosis, thus losing the opportunity for treatment of a syphilitic infection during the darkfield-positive, sero-negative phase.²

It has been pointed out that penicillin therapy for gonorrhea may possibly be administered during the incubation period of syphilis prior to the development of the chancre. Two cases have been seen here in which early manifestations of syphilis were masked by this procedure. It has been suggested that, following the administration of penicillin in such cases, the chancre may be aborted, or altered in appearance, and the early signs and symptoms modified. It is possible, therefore, completely to miss the diagnosis of syphilis in a concurrently infected person. The

¹ MAHONEY, J. F.; ARNOLD, R. C.; and HARRIS, A.: Penicillin treatment of early syphilis; preliminary report. *Ven. Dis. Inform.* 24: 355-357, December 1943.

² MOORE, J. E.; KEMP, J. E.; and others: *The Modern Treatment of Syphilis*. 2d edition. Charles C Thomas, Springfield, Ill., 1943. p. 197.

occurrence of a Herxheimer reaction, in the form of a febrile response during penicillin therapy for gonorrhea, should evoke suspicion as to the presence of syphilis.

CASE REPORTS

Case 1.—A seaman, age 22 years, was exposed sexually on 1 December 1943 and again to the same person on 15 December. On 20 January 1944 a third exposure occurred with another person. No prophylaxis was used on any of these occasions. Five days after the last exposure, he noticed swelling of the prepuce and a urethral discharge, and was admitted to the hospital on 1 February.

Examination disclosed no eruption on the skin or mucous membrane of the genitalia and no generalized lymphadenopathy. The foreskin was edematous and could not be retracted. A creamy discharge exuded from the penis and on microscopic examination showed numerous gram-negative intracellular diplococci. There was a slight, bilateral, painless enlargement of the inguinal lymph nodes. The blood Kahn test was negative.

Penicillin therapy was administered in the form of 20,000 units intramuscularly every 4 hours for 5 doses. After the second injection the already edematous prepuce became more swollen and painful. There was a slight rise in temperature to 101.4° F., which subsided in 24 hours. A penile lesion was suspected and a dorsal slit was made, revealing a pea-size indurated ulcer on the coronal sulcus near the frenulum. Darkfield examination, after completion of 100,000 units of penicillin therapy, showed no *Treponema pallidum*. Examinations were made daily until the ulcer healed at the end of 9 days. Blood Kahn tests were taken every 2 days. No secondary eruption or other clinical signs of syphilis appeared.

On 18 February, 16 days after the first negative Kahn test and the beginning of the penicillin therapy, the Kahn test became four-plus and was confirmed by subsequent examination. Arsenical therapy for syphilis was instituted, and a mild Herxheimer reaction in the form of fever of 101° F. occurred after the first injection of mapharsen. No other signs or symptoms of syphilis could be found.

Case 2.—A steward's mate, second class, colored, age 25 years, was sexually exposed on 1 February 1944, using no prophylaxis. Six days later a urethral discharge appeared and was diagnosed as gonorrheal by microscopic examination. Sulfonamide therapy was administered for 16 days aboard ship. The discharge ceased but recurred 10 days later and the patient was admitted to the hospital on 8 March. He denied any other sexual exposure in the interim.

Physical examination revealed nothing of importance except cream colored "tears" expressed upon massaging the urethra. The smear was positive for intracellular gram-negative diplococci. There was no skin eruption, no penile sore, and no general or local lymphadenopathy. The Kahn test on the day of admission was negative.

On 15 March the patient received 100,000 units of penicillin in divided doses. General malaise and a temperature of 100° F. was observed after 40,000 units had been given. The urethral discharge cleared. While awaiting the final report of the prostatic culture, the patient reported a sore on the

penis. Examination showed a dime-size, shallow, yet somewhat indurated ulcer on the dorsum of the shaft of the penis. There was moderate bilateral painless inguinal adenopathy. No skin or mucous membrane lesions were found, but there was enlargement of the posterior cervical and epitrochlear nodes.

Ten daily darkfield examinations failed to reveal *Treponema pallidum*. Kahn tests, taken every 3 days until the patient was discharged from the hospital, remained negative. Frei and Ducrey tests, for venereal lymphogranuloma and chancroid, repeated at weekly intervals, were negative. Spinal fluid examination showed 4 cells; protein 23 mg. percent; globulin, no increase; Kahn reaction plus-minus; and colloidal gold curve 0001100000. No lymph node puncture for darkfield study was attempted.

The penile ulcer healed in 26 days, leaving a depigmented scar. The epitrochlear, cervical, and inguinal adenopathy persisted, however, and after 8 weeks' hospitalization, the patient was discharged to duty with advice as to follow-up serologic studies. The diagnosis of syphilis could not be made.

SUMMARY AND CONCLUSIONS

A patient who had gonorrhea and a concealed penile lesion was treated with penicillin, producing negative darkfield studies and necessitating awaiting development of positive serologic tests before treatment for syphilis was instituted.

A second patient received penicillin treatment for gonorrhea prior to the development of a penile sore which was then persistently darkfield negative, although the patient later developed generalized lymphadenopathy. The blood Kahn test remained negative and the diagnosis of syphilis could not be made, although syphilis was suspected on clinical grounds. Lymph-node aspiration for darkfield study was not attempted, but this procedure should have been carried out when treponemas were not found in the penile ulcer.

A thorough search for primary and secondary lesions of syphilis should be made prior to the administration of penicillin for gonorrhea. A dorsal slit may be necessary to facilitate the search if the prepuce is not retractable.

The use of penicillin to treat gonorrhea in the presence of concurrent syphilis in the pre-chancro stage may mask or abort the clinical and laboratory signs of the latter and its diagnosis may be missed entirely.

EFFECTS OF SUBTHERAPEUTIC DOSE OF PENICILLIN ON DEVELOPMENT OF PRIMARY SYPHILITIC LESION

REPORT OF CASE

GREYDON G. BOYD
Commander (MC) U.S.N.R.

JOSEPH A. WAGNER
Lieutenant Commander (MC) U.S.N.R.

and
GEORGE F. HEWSON
Lieutenant (MC) U.S.N.R.

The long incubation period of the primary chancre in syphilis has been noted in the literature, from 12 to 40 days being cited as expected limits although commonly the lesion develops within 2 or 3 weeks. In the case to be reported here a typical primary chancre developed more than 60 days after the last sexual exposure.

The possible therapeutic value of penicillin in the treatment of syphilis is under investigation by various groups. It was used empirically in this case. The patient received penicillin in doses sufficient for the treatment of an intercurrent gonorrheal epididymitis but apparently insufficient for the treatment of syphilis, between the time he was last exposed sexually and the development of the primary chancre.

Case report.—A white male, age 23 years, was admitted to the sick list on 6 March 1944 complaining of painful lumps in the groin of 3 days' duration. Previously this patient had been repeatedly admitted to the sick list for gonorrheal urethritis, the first such admission being in 1940. On one occasion the disease was complicated by an acute epididymitis. In March of 1943 he was admitted with a diagnosis of lymphogranuloma venereum.

The present illness followed numerous sexual contacts between 20 November and 3 December of 1943, the latter date being the last possible occasion. On 7 December he was again admitted to the sick list for an acute gonorrheal urethritis. This infection was treated with sulfathiazole in the routine manner applicable to an ambulatory patient and he was discharged to duty under treatment the same day.

A complicating posterior urethritis, prostatitis, and epididymitis later developed for which he was again admitted to the sick list on 6 January 1944. At this time two contacting lesions were noted on the prepuce and coronal sulcus. The lesions were nonindurated, shallow ulcers covered with a dirty gray exudate. The three darkfield examinations which were performed failed to show *Spirochaeta pallida*. The blood Kahn test was negative. The patient

was transferred to a Naval hospital for the treatment of the acute epididymitis, and there two additional darkfield examinations of the material from the previously described superficial lesions yielded negative findings.

His acute epididymitis was treated by the intramuscular administration of 80,000 units of penicillin. The epididymitis, as well as the superficial lesions, healed promptly, and he was returned to duty on 14 January.

On 2 February while at sea he again developed a penile sore on the coronal sulcus in the region of the previously described lesions. This lesion was indolent, indurated, and edematous, and the epithelial surface was eroded. It persisted and showed no signs of healing. Repeated Kahn tests, performed at regular intervals, were negative. On 3 March the painful inguinal adenopathy which constituted his chief complaint appeared.

Following admission, on 6 March, the serous discharge from the lesion was repeatedly found on darkfield examination to contain innumerable actively motile organisms resembling *Spirochaeta pallida*. The blood Kahn test was repeatedly three-plus. The patient was placed on a regime of mapharsen and bismuth, using the 26-week treatment plan. Following the second injection of mapharsen, the lesion was nearly healed.

COMMENT

The incubation period (at least 60 days) in this case is unusual. During this time the patient received 80,000 units of penicillin which was sufficient for the treatment of his gonorrheal epididymitis but far below the suggested amount used in the control cases being treated with this drug because of syphilitic infection.

It is apparent that this relatively small dose is insufficient to cure syphilis. It is also apparent that in this case it is insufficient to prevent the development of the primary chancre. It is suggested that the administration of penicillin may possibly have been the reason for the prolonged incubation period of this primary manifestation of syphilis. Certainly, if the original darkfield-negative lesions were the beginnings of the chancre, then penicillin in the dose administered produced healing of this superficial lesion but was insufficient to prevent the later development of the typical primary lesion.

It is therefore concluded that a subtherapeutic dose of penicillin, administered for the treatment of gonorrheal urethritis or its complications, may modify or obscure the primary syphilitic lesion. Eighty thousand units of penicillin administered intramuscularly in the pre-chancre stage of syphilis was inadequate to prevent the development of clinical syphilis.

MEDICAL AND SURGICAL DEVICES

IMPROVISED METAL PINS FOR SKELETAL TRANSFIXION

MOORE MOORE, JR.
Commander (MC) U.S.N.R.

Metal pins for skeletal fixation are frequently unavailable when they are needed on beginning definitive treatment of fractures. A corrosion-resisting steel alloy has been found to be a most excellent agent for this purpose and its use is advocated by many, providing certain requirements are met. Jones and Lieberman (1) found a high-chromium, low-nickel alloy least objectionable; Darrach (2) showed that adequate fixation tends to reduce the spread of infection, while Hudack (3) discussed in detail the materials used and the proper fabrication of devices for fixation, analyzing the common causes of failure.

The chemical composition of an alloy of the austenitic group recommended by Hudack for resistance to corrosion is as shown in table 1.

TABLE 1.—*Composition of alloy*

Component	Percent
Chromium.....	17-19
Nickel.....	8-9.5
Carbon.....	0.7 maximum
Phosphorus.....	0.1 "
Sulfur.....	0.15 "
Molybdenum.....	optional
Selenium.....	"

This material should be cold-worked which materially increases the Brinell (130 to 170) or relative hardness and decreases its ductility. Final surfacing, polishing and buffing is done with a nonferrous material such as emery cloth. It is then washed in soap and water, alcohol and ether, dried and passivated by immersion in 20-percent nitric acid at 65° C. for 30 minutes to give a molecular coating of chromic oxide. The electrolytic potential is reduced to a negligible amount (10 to 20 ohms). This material has been used for plates, screws and bolts with gratifying results (2) (4).

The Army-Navy specifications for corrosion resisting steel bars and rods used as airplane tram wires are essentially the same and are quoted as follows:

TABLE 2.—*Chemical composition*

Compo- sition	C (Max)	Mn	P (Max)	S (Max)	Cr (Min)	Ni (Min)	Si	Cu (Max)	Mo
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
G	0.12	0.2-2.5	0.04	0.04	17.0	7.0	0.2-1.5	0.50	.....
MCR	0.10	0.2-2.5	0.04	0.04	17.0	7.0	0.2-1.5	0.50	2.00-4.00
FM ²	0.10	0.2-2.5	Note 1	Note 1	17.0	7.0	0.2-1.5	0.50	0.75-max.

G = General. MCR = Maximal corrosion resisting. FM = Free machining.

¹ AN-QQ-S-771 Amendment-2, dated March 21, 1942.

² The phosphorus and sulfur content in composition FM shall be any one of the following compositions:

(a) Sulfur .18% to .35% with the phosphorus .04% max.

(b) Sulfur .10% max. with phosphorus .12% to .17%.

(c) Sulfur .10% max. with phosphorus .17% max. plus a max. of .35% selenium.

In case of combinations (a) or (b) the combined phosphorus and sulfur shall exceed .18%.

The same methods of working the metal are required. This alloy takes and holds a high polish, buffs easily and is nonmagnetic. Any machine shop can readily manufacture skeletal transfixion pins of various diameters and lengths, corresponding to the commercial pins, from airplane wing support rods which have been surveyed or salvaged. A minimum of material is needed.

REFERENCES

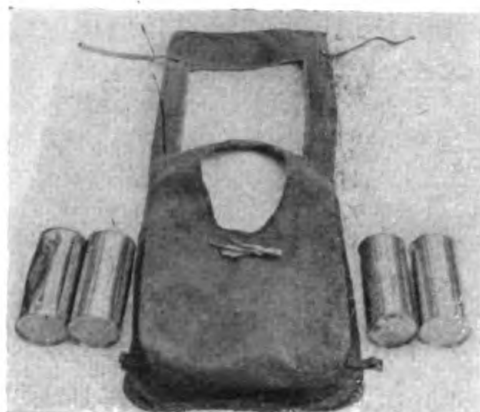
1. JONES, L., and LIEBERMAN, B. A., JR.: Interaction of bone and various metals; vanadium steel and rustless steels. Arch. Surg. 32: 990-1006, June 1936.
2. DARRACH W.: Treatment of compound fractures. Surg., Gynec. & Obst. 66: 815, April 1938.
3. HUDACK, S.: High chromium, low nickel steel in operative fixation of fractures. Arch. Surg. 40: 867-884, May 1940.
4. VENABLE, C. S.; STUCK, W. G.; and BEACH, A.: Effects on bone of presence of metals; based upon electrolysis; experimental study. Ann. Surg. 105: 917-938, June 1937.

METHOD FOR INDIVIDUAL TRANSPORTATION OF PLASMA IN THE FIELD

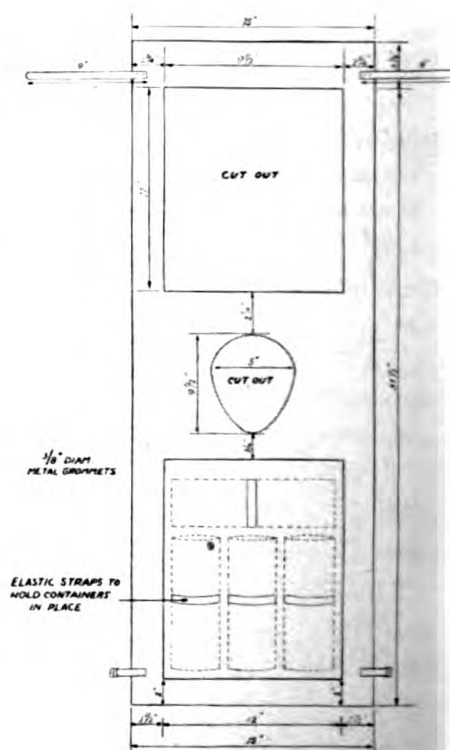
GEORGE LINN WATKINS
Lieutenant, junior grade (MC) U.S.N.R.

The difficulty of individual transportation of plasma units in the field by hospital corpsmen has been due chiefly to lack of a satisfactory carrying device. The "plasma apron" to be described proved a useful means.

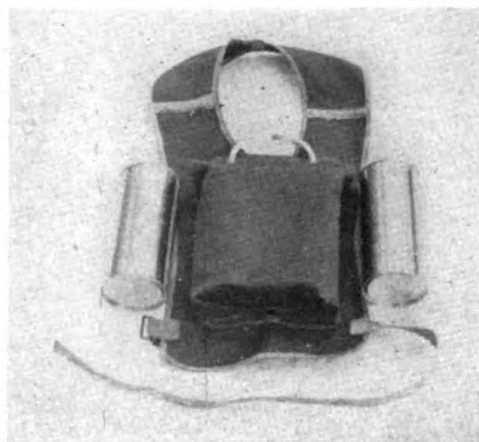
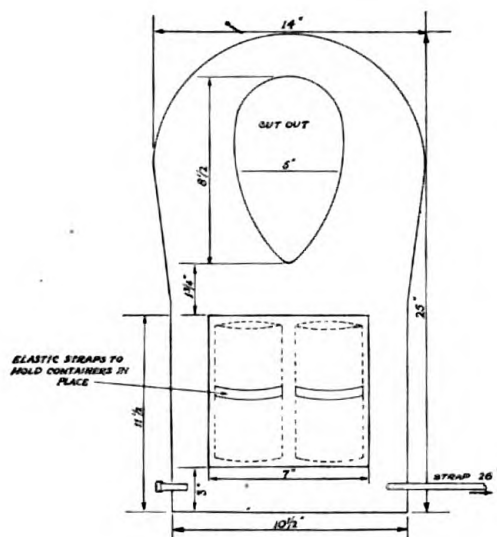
Two aprons have been made, one for carrying two complete units and another that carries one unit. The original idea was taken from a mortar ammunition carrying bag made of light-weight canvas.



1. Full view of the two-unit apron showing head opening, pouch, and back straps.



2. Diagram showing dimensions of the two-unit apron. Note the elastic straps holding the containers in place.



3. Full view of the one-unit apron.

4. Diagram showing dimensions of the one-unit apron. Elastic straps hold containers in place.

The two-unit apron fits on the chest and, as may be seen in figures 1 and 2, has vertical backstraps fitted at the waist to a horizontal strap which fastens on either side to the apron in front. The containers are fitted in the pouch, three vertically and one horizontally (fig. 2). Each is held in place by $1\frac{1}{8}$ -inch elastic straps fastened to the apron. The pouch is closed at the top by straps inserted through two grommets and tying over them. A haversack may be worn over the back and the apron does not interfere with its proper fitting.

It was found that because of the light weight of two containers the vertical backstraps were not necessary in the one-unit apron. In this device a continuation of the apron canvas encircles the neck, and the back is open except for a horizontal strap attached to one side and buckling at the other side of the apron (fig. 3). Here again the containers are held in place by horizontal elastic straps $1\frac{1}{8}$ inches in width (fig. 4). The grommet in the dependent portion of the pouch (fig. 5) permits water to drain out rapidly in the event of a sudden immersion as in falling during a stream crossing.

To summarize the advantages of the plasma aprons: (1) They may be constructed to carry either one or two units; (2) they do not interfere with the wearing or removal of the haversack; (3) the containers are held snugly in place by the elastic straps and are easily removed from the pouch; and (4) the containers'



5. One-unit apron fitted to the wearer with the containers in the pouch.

buoyancy obviates the necessity of removing the aprons in the event of a sudden immersion in deep water. These aprons were designed to hold the 250-cc. units. However, because of their adjustable elastic straps, the aprons may be adapted to the use of 500-cc. units.



LIFE-LONG IMMUNITY CONFERRED BY YELLOW FEVER

The belief in a permanent life-long immunity conferred by an attack of yellow fever finds confirmation in all the experimental evidence obtained by the protection tests with monkeys and mice, as illustrated by the author's recent experience which shows that his blood serum 77 years after a primary attack of yellow fever is protective and life-saving to mice.—MATAS, R.: Permanent presence of specific immunizing antibodies in blood of yellow fever subjects. *New Orleans M. & S. J.* 97: 9-13, July 1944.

REFRIGERATION OF WOUNDED EXTREMITIES

JOHN P. OTTAWAY

Lieutenant Commander (MC) U.S.N.R.

and

JOHN J. FOOTE

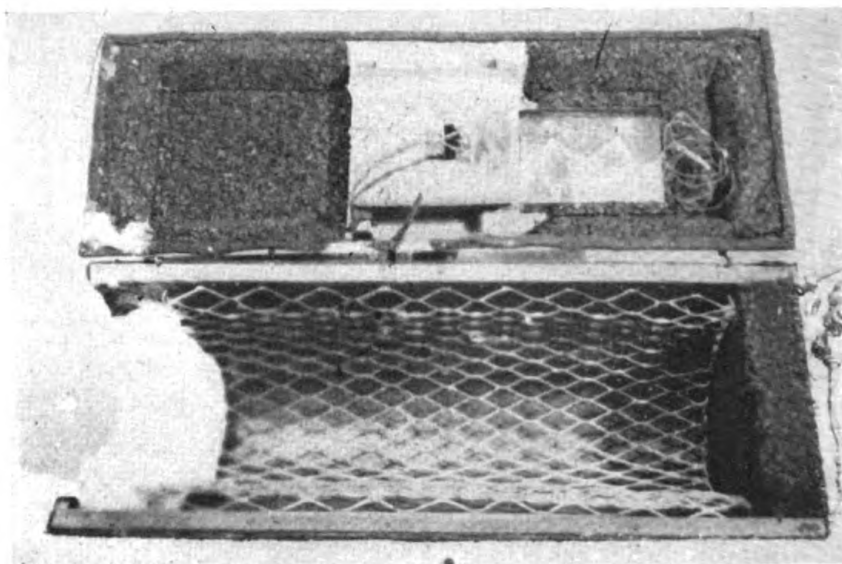
Lieutenant (MC) U.S.N.R.

Refrigeration of extensively traumatized extremities may possess several advantages for the war casualty, especially in those patients in profound shock and those in whom surgery should be postponed for other reasons. Chilling of the tissues to just above the freezing point (2° C.) produces anesthesia, reduces absorption of toxic products, inhibits bacterial growth, and reduces the metabolism of the injured part to the point where even the collateral blood supply is adequate. A workable method of applying refrigeration to the wounded aboard ship was therefore sought.

Controlled refrigeration by means of connecting the Freon unit of a drinking fountain with an insulated cabinet was achieved in the manner to be described. The required skill and materials to construct this unit are available aboard Navy ships of average size.

The refrigeration unit (designed and built by Lt. F. W. Deily, USNR), the overall dimensions of which were 36 inches by 15 inches, was made as follows: Copper tubing, $\frac{1}{4}$ inch in diameter, was bent in a 2-inch radius to form a solenoid curve of sufficient length to extend across the long axis of the unit. This was spot-soldered at 12-inch intervals to the outside of a sheet of $\frac{1}{16}$ -inch copper bent to form the inside curve of the unit. The ends of the tubing were brought out on the distal end of the unit and connected through a $\frac{1}{2}$ -ton automatic expansion valve to a $\frac{1}{4}$ -ton Freon unit taken from a scuttlebutt. The tubing was covered with a $\frac{1}{2}$ -inch layer of steel wool to serve as a conducting link along the length of the tubing to the inside sheet. This was covered with a 1-inch layer of hair felt and the whole covered with a second sheet of $\frac{1}{16}$ -inch copper. The distal end was shaped from 2-inch cork and a collar of cork was fitted to the proximal end.

The cover was made of $\frac{1}{2}$ -inch oak, lined with shaped cork 1 inch thick. A window containing an insulating air space was cut in the cover near the distal end and a fan inserted. It was found that a baffle covering the fan blades provided protection and the maximum amount of distribution of air within the box.



View of cabinet from above, cover reflected.

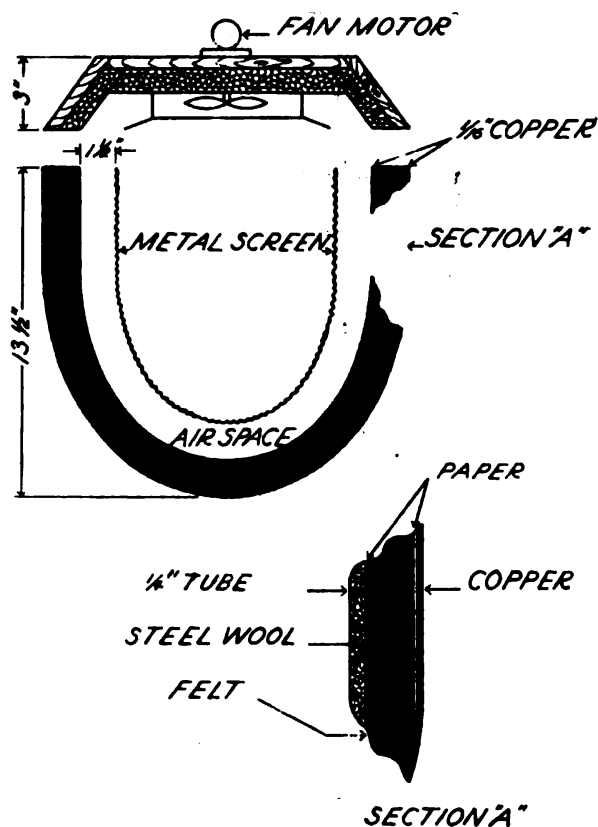
Heavy wire mesh was bent to provide a support for the patient's extremity with a 2-inch air space between the extremity and the lining of the box. It was used in the following case with gratifying results.

A 28-year-old patient was brought aboard ship approximately 3 hours after having been struck in the thigh by a shell fragment. Shock treatment was immediately instituted and after satisfactory response the tourniquet and dressings were removed. The leg was found to be cold and cyanotic and no pulsating vessels could be palpated. There was a wound of entry on the posterolateral aspect of the upper third of the right thigh 8 by 4 by 2 cm. and a wound of exit on the anteromedial aspect at the same level 20 by 10 by 6 cm. The fragment had passed posterior to the femur without injuring it but had severed the femoral artery and vein 6 cm. from Poupart's ligament.

The vessels were ligated, the wounds were cleaned and irrigated, through-and-through drainage was established, the wound surfaces were dusted with sulfanilamide powder and the wounds were packed loosely with vaseline gauze. The entire leg was then placed in the refrigeration unit which had previously been chilled to 2° C.

During the first week the temperature of the unit was maintained at between 2° and 4° C. The leg slowly lost most of the cyanosis and developed considerable edema. An area of necrosis, about 3 by 4 cm., appeared at the lower aspect of the wound. However the patient's temperature remained below 100.8° F., and, supported by repeated transfusions of blood and plasma, his general condition was excellent.

During the next three weeks the temperature of the unit was raised by increments of 2° C. every few days until 14° to 16° C. was reached. The leg continued to maintain its satisfactory color, lost its edema after elevation, and showed slow return of color after pressure blanching. The patient's condition remained excellent and his temperature remained below 101.4° F. Repeated dressings showed that the area of necrosis did not increase in size and there was no evidence of gross infection.



A beginning line of demarcation became apparent on the twenty-sixth day at a level just above the knee, and spots of incipient dry gangrene between the toes were noted at the same time. The temperature of the unit was immediately dropped to 0° C. and the patient was transferred on the twenty-eighth day. Amputation just above the knee, approximately some 10 cm. below the lower edge of the wound, was performed on the twenty-ninth day.



PSYCHONEUROSES AND MALARIA

Psychoneuroses and malaria of neurasthenic, depressive, or anxious types, may evidence a latent malaria and respond to anti-malarial therapy. Generally, a tropical psychoneurosis has so many other imputable causes than simply malaria that the latter cannot fairly be deemed etiologic. Among psychoneuroses there is no formal entity corresponding to a postmalarial psychosis.—HUDDLESTON, J. H.: Notes on psychoses and psychoneuroses with malaria. *M. Bull. Vet. Admin.* 21: 1-4, July 1944.

WARDROOM OPERATING TABLE FOR DESTROYERS

CHARLES MRAZEK
Lieutenant (MC) U.S.N.R.

It has recently been advised that the wardroom of a destroyer be used as the forward battle dressing station, utilizing the officers' mess table as the operating table. This is very inadequate for the purpose because of the width and fixed location of the mess table. Its disadvantages include prohibiting of proper draping and therefore asepsis is questionable; hindrance to surgical assistance and the inconvenience to the operator of bending or stooping over the table; difficulty in confining the patient to the table; and finally, difficulty of administering anesthesia as there is no simple method of raising or lowering the head of the table.

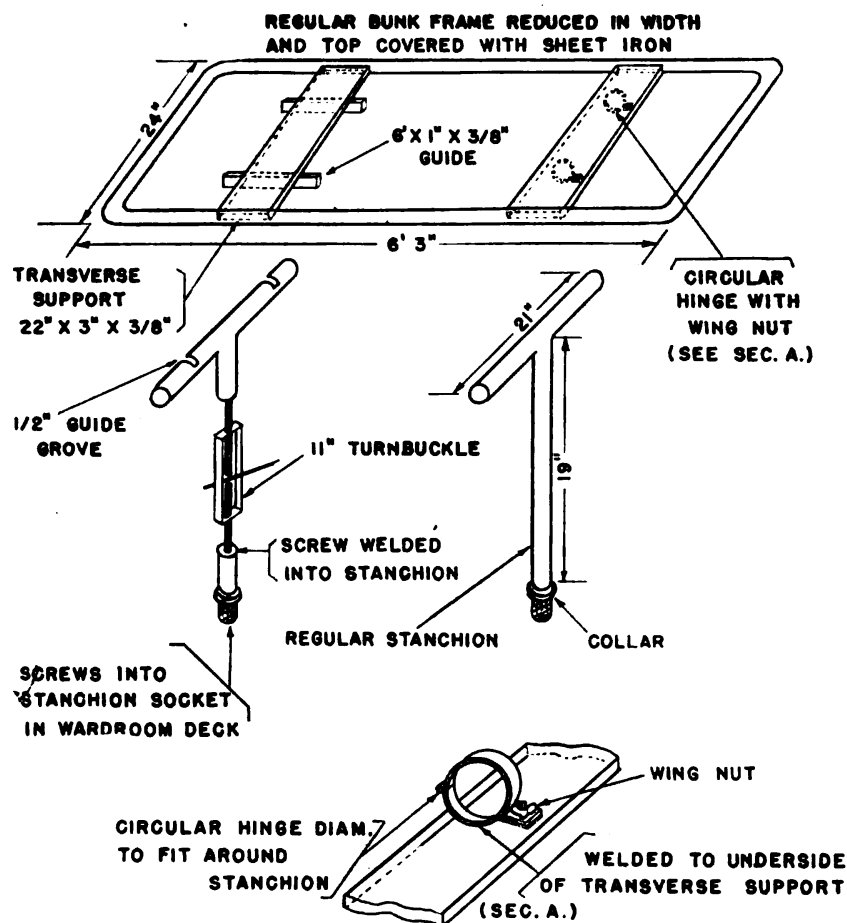
To facilitate smooth functioning of the available personnel in the event of an emergency, a new operating table was constructed from material available aboard this destroyer. The officers' mess table was draped and used as an instrument table; if necessary it can be kept sterile for successive operations.

The base of the table is made from two stanchions which are screwed into the deck in stormy weather and are normally used as supports in the wardroom. The first stanchion, measuring from the collar, is cut 29 inches in length and a transverse cross-piece 21 inches in length is welded to it so that when the part is completed it resembles a letter T.

The second stanchion is similar but differs in two details. Incorporated in the shaft is an 11-inch turnbuckle with two screws. By adjusting the turnbuckle the length of this shaft can be decreased or increased as desired. This is shown in the accompanying illustration. The second difference is in the top cross-piece which has two transverse guide grooves $\frac{1}{2}$ inch wide on each side (see illustration). The under surface of the table top is made to fit into these grooves, keeping the crosspiece from turning while the head of the table is lowered or elevated.

The table top is made from a standard destroyer bunk frame reduced in width to 24 inches. Two iron crosspieces, 22 by 3 by $\frac{3}{8}$ inches are welded transversely at the head and foot of the frame. The table top is covered with sheet metal welded to the frame.

The transverse iron crosspiece at the foot of the table has two



Wardroom operating table.

circular hinged rings welded to the underside. These rings encircle the top crosspiece of the first stanchion and can be locked with a wing nut when the table is assembled (section A, illustration). The second iron crosspiece is welded transversely at the head of the table. Two 6 by 1 by $\frac{3}{8}$ -inch iron strips, on end and parallel to the long axis are welded to the underside of the crosspiece. These pieces are so spaced that they rest in the guide grooves of the stanchion with the turnbuckle. The distance between the frame crosspieces depends upon the distance between the stanchion sockets in the wardroom deck where the table is to be used.

The table is very stable and can be assembled by screwing the stanchions into the deck and securing the top of the table by locking the circular hinges. The table can be dismantled in a few seconds and secured against any bulkhead. It has proved to be a satisfactory operating table, and by using the wardroom mess table for instruments, ample room for working is obtained and

conditions are reached which closely simulate those of an operating room.

Recently an emergency major abdominal operation was performed aboard this destroyer. The operation was carried out in a moderate sea with three pharmacist's mates, who had no previous operating room experience, assisting. The operation was performed under spinal anesthesia with ease and without confusion in the wardroom. It is believed that the table described here was a dominant factor in the success of the operation.



GERMICIDAL SURFACE ACTIVE AGENTS

During the past decade, a new class of germicidal agents known as invert soaps or cationic surface active agents was introduced to the pharmaceutical and medical professions.

Any substance which decreases or otherwise modifies the interfacial tension, viz., the tension at the boundary surface, between two phases of matters, i.e., liquid-solid, liquid-liquid, or liquid-gas, is a surface active agent. There are anionic, cationic and non-ionic agents.

Chemically, surface active agents or interfacial modifiers consist of two component parts, a hydrophilic group which tends to make the compound water soluble, and a lipophilic group which tends to impart oil-soluble characteristics.

In anionic agents, the lipophil group is part of a negative ion and usually is a long-chain hydrocarbon or other oil-soluble group.

In cationic agents, the lipophilic group is part of the positive ion.

The non-ionic agents consist of two non-ionizable groups.

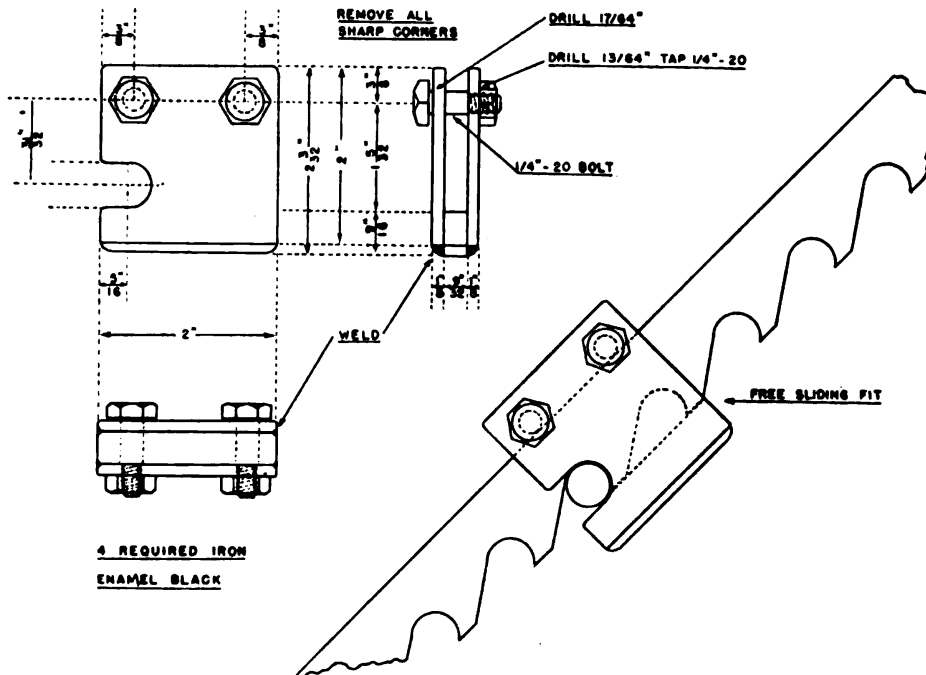
Many anionic and non-ionic agents are not as readily absorbed by bacteria as the cationic agents. Therefore, it has been among the cationic agents that investigators have looked, within recent years, for potential germicidal agents. When cationic agents are absorbed upon bacteria, they appear to exert a marked inhibitory effect upon the metabolism and viability of these organisms. Since they are highly surface active, they disturb the functioning of the bacterial surface membrane.

As the bacteria adsorb the cationic agents, it is thought that a combination is formed which prevents or retards the normal adsorption of specific nutritional cationic substances which are necessary for the metabolic processes of the bacteria. In this manner, the cationic agents may prove to be genuinely germicidal.—TAUB, A.: Surface active agents as germicides. The Merck Report 53: 28-31, July 1944.

SAFETY LOCK FOR FOLDING FIELD OPERATING TABLE

JUSTUS M. FLEMING
Commander (MC) U.S.N.R.

Some difficulty has been experienced in maintaining in position the head and leg rests of the standard Navy folding field operating table. Any slight movement of the patient in position on the table tended to dislodge the ratchets supporting the head and foot rests, allowing these to fall out of position and endangering the security and safety of the patient.



Safety lock for operating table head and leg rest.

Request was made for a safety lock which would be simple in operation and positive in action. The resulting design is shown in the accompanying illustration. This lock was designed and made by Samuel H. Lutz, machinist's mate, first class, and operates so satisfactorily that we wish to make it available to others who may be experiencing similar difficulty with this type of table.

EDITORIALS

PENICILLIN

Within the brief span of 4 years there has accumulated literature on penicillin so voluminous that it defies compression into any single essay. Every phase from discovery to therapeutic failure has an exhaustive representation and subsequent writings appear to fall into a humdrum of repeated experiences.

This situation has been brought about by intelligent forethought in the control and distribution of penicillin and the collation of the reports of its therapeutic effectiveness. Thus a precedent for the release of a drug has been established which foils any exploitation before proper evaluation of its therapeutics can be acquired—a procedure which commands subsequent use. This is particularly true because as penicillin data accumulate other related substances are being investigated, some offering promise of even greater possibilities. The potentialities of biotherapy as distinct from chemotherapy are limited only by the restrictions of research, and the consequences of uncontrolled application are apparent.

Elsewhere in this issue of the BULLETIN there is found an aggregate of papers on penicillin which depicts a variety of experiences, some new, some unusual, some adding to a phase repeatedly discussed in the literature, the whole presenting a few more facets to the already expansive therapeutic mosaic of the drug's effectiveness.

The use of penicillin in granulocytopenia, yaws, phagedenic ulcer and human bite broadens the applicability of the drug, whereas employment in primary atypical pneumonia and subacute bacterial endocarditis presents a phase worth further trial.

Penicillin in the treatment of venereal diseases is so effective that it may be considered the greatest single outstanding therapeutic contribution since Ehrlich's memorable discovery. The benefits to be derived from such an agent in the treatment of venereal diseases are obvious and hold much promise for the early control of gonorrhea and syphilis in the armed forces.

Penicillin has reached the stage at which its efficacy in a wide variety of diseases is established. For a fuller realization of its

potentialities its limitations as well as its benefits should be appreciated. It is not a panacea by any means. The organisms and conditions upon which it is effective are well known. With the exception of authorized clinical investigation, the restrictions of its use to infections caused by pathogens which are known susceptibles, will do much toward avoiding a depreciation of medicine's most potent therapeutic agent.

STREPTOCOCCUS MG AND PRIMARY ATYPICAL PNEUMONIA

Despite the tremendous research into the cause of primary atypical pneumonia, etiology unknown still remains an essential suffix of the terminology. Although irrefutable evidence is lacking, most investigators consider a virus to be the causative agent of the disease. The recovery of a number of different viruses from patients with primary atypical pneumonia has supported this view.

A virus apparently infectious for mice, guinea pigs and ferrets¹ and one infectious for the mongoose² have been isolated. Two viruses^{3,4} recovered from cats have been described as causing primary atypical pneumonia in man. Recently Eaton and his collaborators^{5,6} have investigated an agent in sputum and lung tissue from certain cases of atypical pneumonia which was transmissible in chick embryos and capable of producing pulmonary lesions by intranasal inoculation in either cotton rats or hamsters.

The presence of latent agents antigenically related to the pneumonia virus of mice, cotton rats, hamsters and rabbits have been demonstrated⁷ and are not ruled out in these reports.

¹ STOKES, J., JR.; KENNEY, A. S.; SHAW, D. R.: New filtrable agent associated with respiratory infections. *Tr. & Stud., Coll. Physicians, Philadelphia* 6: 329-333, February 1939.

² WEIR, J. M., and HORSFALL, F. L., JR.: Recovery from patients with acute pneumonitis of virus causing pneumonia in mongoose. *J. Exper. Med.* 72: 595-610, November 1940.

³ BLAKE, F. G.; HOWARD, M. E.; and TATLOCK, H.: Feline virus pneumonia and its possible relation to some cases of primary atypical pneumonia in man. *Yale J. Biol. & Med.* 15: 139-166, December 1942.

⁴ BAKER, J. A.: Virus obtained from pneumonia of cats and its possible relation to cause of atypical pneumonia in man. *Science* 96: 475-476, November 20, 1942.

⁵ EATON, M. D.; MEIKLEJOHN, G.; and VAN HERICK, W.: Studies on etiology of primary atypical pneumonia; filterable agent transmissible to cotton rats, hamsters, and chick embryos. *J. Exper. Med.* 79: 649-668, June 1944.

⁶ Editorial: Etiology of primary atypical pneumonia. *J.A.M.A.* 125: 851-852, July 22, 1944.

⁷ CURNEN, E. C.; MIRICK, G. S.; ZIEGLER, J. E., JR.; THOMAS, L.; and HORSFALL, F. L., JR.: Studies on primary atypical pneumonia. I. Clinical features and results of laboratory investigation. In press.

Recently Thomas and his associates ⁸ have isolated a nonhemolytic streptococcus from the lungs of patients who have died of primary atypical pneumonia. Designated *Streptococcus MG*, it was shown that convalescent sera of numerous patients with atypical pneumonia were capable of agglutinating the microorganism and some yielded precipitates with appropriate extracts of it. Evidence has been obtained which indicates that the strains of this organism constitute a homogeneous group, belonging to a single serologic type and may readily be differentiated from other varieties of nonhemolytic streptococcus. It was shown, moreover, that positive serologic reactions obtained with this streptococcus and convalescent sera from patients with primary atypical pneumonia were due to specific antibodies which developed during the course of the illness.

The microorganism has been isolated from 53 of 97 patients with primary atypical pneumonia and has been recovered from patients suffering from acute respiratory infection without pneumonia, as well as from pneumococcal pneumonia and other forms of bacterial pneumonia. It was also isolated from the throat cultures of 7 of 57 normal persons.

The organism is highly resistant to the bacteriostatic action of a sulfonamide although it is susceptible to the effects of penicillin.

Since *Streptococcus MG* was found nonpathogenic for any common laboratory animal, its significance in relation to primary atypical pneumonia is obscure. It was observed, however, that patients who developed antibodies against the organism were more ill than those who did not. This was appraised by the duration of the illness as a whole as well as by the duration of fever, of abnormal physical signs, of roentgenologic evidence of the disease and the length of hospital stay.

It is admitted that the possibility of a symbiosis between the streptococcal organism and a virus which may be the sole causative agent has not been ruled out. The presence, however, of an organism with distinct antigenic properties in considerable numbers in the lungs of patients who died of atypical pneumonia seem to augur against this view.

That *Streptococcus MG* is not a secondary invader with only a random or accidental association between an infectious agent and a disease, is demonstrated by the frequency with which this par-

⁸THOMAS, L.; MIRICK, G. S.; CURNEN, E. C.; ZIEGLER, J. E., JR.; and HORSFALL, F. L., JR.: Studies on primary atypical pneumonia. II. Observations concurring relationship of nonhemolytic streptococcus to disease. In press.

ticular organism is recoverable from patients suffering with the disease.

Whatever the pathogenicity of primary atypical pneumonia, it seems from these studies that *Streptococcus MG* is implicated in no uncertain or subordinate way.

FOOD AND WOUND HEALING

The loss of essential body elements from badly injured tissues has been repeatedly observed and is responsible for intense investigation on replacement therapy.

What effect food and diet have on wound repair is not generally recognized. Wiles¹ attributed much of the success in the treatment of battle casualties during the Middle East campaigns to the good health and nutrition of the troops. Adolph² has shown that the surgical end-results in the impoverished, emaciated Chinese soldiers returning from the front were improved by administering an adequate diet for 1 week prior to surgery. The association of protein deficiency and wound disruption is more than casual, and delayed wound healing, especially as manifested by wound disruption, occurs frequently in the proteinemic patient.

The influence of other elements of the diet, however, has not been as positive. The exploitation of vitamins has clouded the appraisal of these substances, some maintaining that their only value is in the prevention and treatment of specific deficiency diseases.

The influence of vitamin C on wound healing however has recently been reviewed³. It has been shown that the deficiency need not be extreme before normal bone repair is interfered with, and at least in experimental animals there is a correspondence between the total blood vitamin C and the tensile strength of soft tissue wounds⁴.

Conversely, Crandon et al.⁵, Pijoan and Lozner⁶ and others have

¹ WILES, P.: Analysis of battle casualties admitted to Middle East hospitals, April 1, 1942, to March 31, 1943. *Lancet* 1: 523-525, April 22, 1944.

² ADOLPH, P. E.: Preoperative measures used in war surgery in China; with special reference to delimiting tourniquet. *Ann. Surg.* 119: 246-252, February 1944.

³ Editorial: Food and healing of wounds. *Lancet* 1: 727, June 3, 1944.

⁴ BOURNE, G. H.: Vitamin C and repair of injured tissues. *Lancet* 2: 661-664, December 5, 1942.

⁵ CRANDON, J. H.; LUND, C. C.; and DILL, D. B.: Experimental human scurvy. *New England J. Med.* 223: 353-369, September 5, 1940.

⁶ PIJOAN, M., and LOZNER, E. L.: Physiologic significance of vitamin C in man. *New England J. Med.* 231: 14-21, July 6, 1944.

found that even after many months on a diet completely deficient or extremely low in vitamin C, human experimental wounds apparently healed normally, as far as clinical and histologic studies could detect.

Bourne⁷ however has recently demonstrated that despite the normal histologic appearance of wounds as seen by stained biopsy specimens, the tensile strength of the lesion varied with the daily dose of vitamin C administered. Furthermore it has been pointed out that had the human wounds been submitted to tensile strength tests they would not have been thought of as healed, and regardless of the histologic normal appearance they could have been shown to have been mechanically weak.

On the other hand, the mobilization of vitamin C in the healing wound at the expense of other tissues of the body, its influence on tissue resistance to infection and the relationship of the tensile strength of the resultant scar to the vitamin-C content, place an importance on this substance that demands practical consideration.

Irrespective of the theory to which one subscribes regarding wound healing, the diet of the wounded, especially those with large suppurative wounds, merits of the therapist considerably more attention.

⁷ BOURNE, G. H.: Effect of vitamin-C deficiency on experimental wounds. *Lancet* 1: 688-692, May 27, 1944.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

HUMAN CONSTITUTION IN CLINICAL MEDICINE, by *George Draper, M.D., Associate Professor of Clinical Medicine, College of Physicians and Surgeons, Columbia University; C. W. Dupertuis, Ph.D., Physical Anthropologist, Constitution Clinic, Presbyterian Hospital, New York City; and J. L. Caughey, Jr., M.D., Med.Sci.D., Associate in Medicine, College of Physicians and Surgeons, Columbia University.* 273 pages; illustrated. Paul B. Hoeber, Inc., New York, publishers, 1944. Price \$4.

This volume represents the attempt of two internists and an anthropologist to bring to medical students the concept of the individual as a whole. It contains a great deal of wisdom. It is psychosomatic medicine from the standpoint of the internist; it is psychobiology without the jawbreaking terminology which has made people suspicious of it. It represents an ideal in the practice of medicine—medicine as it should be practiced and as we hope some day it may be practiced. It decries looking at man simply as a container for diseased organs and calls attention to the fact that there is an essential relationship between each individual person and the disease from which at any moment he or she may suffer. It is an interesting, lucid, and extremely important work, and medical students and physicians would do well to read it.

The introduction could be read with profit, for that matter, by all medical students and graduates. Among other things it states, "That the patient is anything more than a bundle which for him is painful and for the doctor interesting is a concept which does not match the care with which biologists select their experimental animals." One can disagree with the ideas of the idealist philos-

ophers whom they quote, but the conclusions which the authors draw are sound.

Many essays could be written in review of this book; for instance one about the education of medical students, the manner in which the premedical requirements in the sciences lead the undergraduate student to encroach upon time which should be allocated to courses supporting a more liberal education. One could write on the need for a thorough grounding in the humanities in order to obtain proper understanding of man—for in the final analysis, understanding of man and his particular manifestation of disease is the goal of medicine—yet in most of our medical schools the study of the human animal, an essential element in any disease process, is neglected.

The chapter on history-taking or clinical biography is especially worth while. It cautions the young doctor against the stereotype printed history blank, annoying to the patient and boring to himself, for in its use the young physician is liable to chronicle a disconnected set of facts which will never add up to the patient in the bed before him.

The chapter on the male and female elements of the human constitution entitled "The Mosaic of Androgyny" is an interesting one and in itself raises many questions. A chapter on Anthropometry is included in the book. The discussion of constitutional physiology and the clinical use of constitutional studies, and the final chapters on the unity of organisms, are quite worth while.

The theory of constitution in relation to disease presented in this work sprang from observations made during the epidemic of infantile paralysis in 1916. The type of medicine which it advocates is Oslerian in its astute, understanding, all-absorbing and philosophical approach. It represents the type of medicine which is practically impossible for the harassed and overburdened general practitioner to undertake. It seems as though it would require full-time service, a solid background and much speculation, but in the end it would be rewarding and gratifying. One question might be asked as we contemplate this book: Can medical students really understand and grasp this type of work; isn't it a little above them? If they can understand it, then we have already come a long way, and if they cannot, their teachers should read it.

MEDICAL PHYSICS, Editor-in-Chief, *Otto Glasser, Ph.D., Head, Department of Biophysics, Cleveland Clinic Foundation; Professor of Biophysics, Frank E. Bunts Educational Institute; Consulting Biophysicist, University Hospitals of Cleveland, Cleveland, Ohio; with the assistance of 23*

associate editors. 1,774 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1944. Price \$18.

"Medical Physics" should be placed in the library of all medical schools and research laboratories if only because of the great mass of material (1,744 pages) presented, and the wide diversity of the subjects covered. The book supplies a vital need in that it covers in a single volume almost the entire realm of what one may term the "hybrid" medical sciences. As the title implies, however, the stress is on physics.

In the compilation, one is brought to realize that the armamentarium of modern medicine is to a great extent an outgrowth of the physical sciences. The electrocardiogram itself, the electroencephalograph, electron-microscope, audiometers and hearing aids, the ultra-centrifuge, roentgenologic instruments, and many other diagnostic and therapeutic aids require more than a superficial knowledge of physics for their judicious application.

The work, perhaps unfortunately, cannot be classed as a textbook or source book, since a great deal of basic (elementary) material is lacking, and a general knowledge on the part of the reader of the fields encompassed is assumed by the various contributors. The surgeon and the internist may therefore find much of the material too highly technical for ready appreciation, other than in fields related to his own specialty.

If one may have the temerity to criticize such a useful work, such criticism must stem from the general tendency of the majority of contributors to present controversial material according to their personal views and without full and unbiased discussion of contrary evidence and theories. This means of presentation would be a virtue in many of our medical texts (already too voluminous to permit even a cursory reading by the student) but is a distinct fault in an authoritative review for the specialized professional reader. This criticism may, on the other hand, be unjustified on the ground of practical consideration since any further elaboration of the fields discussed could hardly be compressed into a single volume.

The associate editors of "Medical Physics" were drawn very largely from the Cleveland area (only seven out of twenty-two being professionally engaged elsewhere), and this selection of editors perhaps tends to engender somewhat circumscribed viewpoints. It may perhaps be noted that thirteen of the associate editors were selected from the Cleveland Clinic and Western Reserve University.

Certainly, "Medical Physics" represents a very sincere attempt to present the physical basis upon which so much of modern medi-

cine rests, and should prove most useful in teaching and research institutions, and to those of the medical profession, the practice of whose specialty requires the understanding and use of the tools supplied by the physicist.

CLINICAL LECTURES ON THE GALLBLADDER AND BILE DUCTS, by *Samuel Weiss, M.D., F.A.C.P., Clinical Professor of Gastroenterology, New York Polyclinic Medical School and Hospital.* 504 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1944. Price \$5.50.

This new book by Polyclinic's Samuel Weiss is an excellent general treatise on all phases of the gallbladder and bile ducts. The chapter on history and physical examination contains many diagnostic pearls. If nothing else, the listing of the many diseases confusable with gallbladder disease should serve once more to remind the busy practitioner of the necessity of a complete and careful history and physical examination. Although even the author would probably admit that many of the diagnostic suggestions do not frequently pass through his mind, and many of the diagnostic procedures are superfluous, there are, no doubt, occasional cases when the extra time would be well spent. It is refreshing to read a book in which the intricacies of the physical examination instead of laboratory procedure are stressed.

Dr. Ernest E. Smith, Radiologist of the New York Polyclinic, has contributed a valuable chapter on radiology of the gallbladder, complete with details of cholecystographic technic and a discussion of the interpretation of the cholecystogram.

Duodenal drainage for both diagnosis and therapy is adequately explained by Eberhard of Philadelphia, and this chapter is typical of others in the book in that suggestions in technic are clearly and amply stated instead of being left to the practitioner's imagination.

The chapters on treatment are adequate and complete, though the surgeon might complain that the accent is unduly laid on medical management. However this book does not pretend to be a treatise on the surgical management of the gallbladder patient, and this can certainly be excused.

The book concludes with chapters on Gallbladder and Arthritis, Gallbladder Disease and Cardiac Involvement, Tumors of the Gallbladder and its Ducts, Jaundice, Liver Function and Hypoprotrombinemia with a note on Vitamin K Therapy.

It is well-printed, and the bibliography is complete. It is well-illustrated—one might say too well in the cases of figures 12 and 13 in which a curvesome model peers over her shoulder at the

sympathetic viscerogenic gallbladder reflex pathways represented as originating in a dotted triangle under her full right breast.

GUIDING THE NORMAL CHILD, A Guide for Parents, Teachers, Students, and Others, by Agatha H. Bowley, Ph.D.; with a foreword by *D. R. MacCallman, M.D., Crombie-Ross Lecturer in Psycho-Pathology, University of Aberdeen.* 174 pages. Philosophical Library, New York, publishers, 1943. Price \$3.

The pathologic can only be determined if the physiologic norm is known. Medical men, psychologists, and educators have spent a great many years measuring, evaluating, and classifying the hypothetical norm, which in the field of child psychology remains almost as elusive and arbitrary as ever. Agatha Bowley, in "Guiding the Normal Child," presents what is to an American a rather fresh approach. Behaviorists may not agree with her, nor admit a sound basis for her beliefs. Dr. Bowley does not mean the same things as the Americans do by growth and development, for she is not, as are most Americans in this field, a behaviorist who measures overt behavior, but belongs to the British dynamic school which believes the instinctive and emotional expressions, or "inner drives," are only guided and molded by environment. It is a broader and on the whole much less scientific method by which to study the child. Through the eyes of Dr. Bowley it also expresses a most sympathetic point of view.

The British author organized and directed the very successful Dundee Child Guidance Clinic, has had experience in general and nursery school teaching, and is a lecturer in a teachers' training college. Much of the material in her brief case reports was obtained while she was teaching at Byron House School in London.

To one trained in child psychology in this country there may be disagreement on such points as soothing the baby who cries in anger, viewing temper tantrums as healthy in the preschool years, reading into the infant's reactions, reasons and emotions which are not measurable, and placing the development of character and personality on a predetermined emotional basis. There will not, however, be much to criticize in the wholly sensible and simple presentation of the material. Never for a moment has the author become so involved in the special vocabulary of her profession that she has forgotten an audience that may be wholly unfamiliar with the cant; there is nothing here that is over the head of anyone not schooled in psychology. The book is written primarily for the student who is training to be a teacher, but should be of much practical help to parents as well. It covers the period, rather sketchily to be sure, from infancy to adolescence, but in this reviewer's opinion does not lose thereby, as it

serves to tantalize the reader into further study of child psychology and provides at the end of each chapter a good-size bibliography drawn from the best known works in child psychology.

To this reviewer the chapter on "Children and the War" was most interesting. Reactions of these children of all ages to air raids, bombings, and evacuation, will have a profound influence on their lives. In one class, in a free drawing period, only 17 of 222 children drew pictures related to war. Their list of things missed in wartime, their reactions to shelters, as well as the attitude of parents, what the author terms "mental first aid," prove again that "Britain can take it."

Medicine, education and psychology, points out the author, must develop side by side. The doctor, the teacher, and the psychologist can surely learn from each other. They are all equally concerned with the satisfactory growth and development of the child. For this reason, the doctor as well as the parent and the educator will find much in this book that is of interest, much more that tempts further investigation.

FUNDAMENTALS OF OCCLUSION, by *Samuel Hemley, D.D.S., F.A.C.D., Head of the Department of Orthodontics, New York University, College of Dentistry*. 377 pages with 504 illustrations on 286 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price \$6.50.

As Dr. Hemley states, his text is written for undergraduates; however the graduate dentist would be benefited by a careful evaluation of the first two chapters on occlusion. While the author's views on occlusion are sound and represent the opinions of accepted authorities, his book nevertheless incites the experienced orthodontist's animosities, since it deals so often not with cases, but with a discussion of orthodontic personalities. The obvious influence of the author's close associates in orthodontics has dulled his perception of the possible value of other equally as earnest workers whom he eliminates from any consideration. In this respect he contradicts his words from the preface . . . "truth alone, is the true criterion . . ."

The chapter on bone is well assembled and gives a didactic but excellent review of the histology of bone. His description of the periosteum with its functions and osteogenic powers is excellent.

The development of the maxilla and mandible is concisely reviewed with selected illustrations from Strang, McCall and Wold, Noyes, Schour, Brodie, Humphrey, Brash, Todd and others. The forces of occlusion, including the inherent forces of growth, metabolism, muscle action in mastication, expression and deglutition, the temporomandibular articulation with its mechanics,

the inclined planes of the teeth, axial inclination, the vertical component of force, proximal contact points, and atmospheric pressure, are all clearly described.

His discussion of the etiology of malocclusion, prenatal and post-natal factors, and local causes, deserve close study by the reader. For the main part the author's case illustrations are taken from members of the same race; if he had used a greater cross-section of individuals his conclusions would have a firmer basis.

Angle's classification of malocclusion is well described together with its discrepancies, which have been recognized for some time. The relationship of the condyles in the glenoid fossae is stressed with ample justification; however the use of oriented casts would have expedited his discussion and verified to the reader the authenticity of the statements made. Particularly is this true in his presentation of open bites, and their relation to the vertical dimension of the face.

The author's discussion of the classifications of Angle, Bennett, Stanton and Simon reveals his incomplete interpretation of their theories. Especially is this true of his conception, "the fallacy of Stanton and Simon theories." It is evident he has not experienced the clinical application of Simon's instrument, or he would understand the interpretation Simon has always intended in applying his principles of correction.

Dr. Hemley's description of the tissue changes associated with tooth movement deals with the nature of intermittent force, degree of force, the site of traction, excessive force, and the nature of tooth movement. Illustrations from Oppenheim, and opinions of Kronfeld augment his discussion.

While this critic does not agree with all the didactic statements of the author, his book nevertheless is recommended, because it provokes considerable thought on the factors of occlusion. These factors may be utilized not only by the orthodontist and the general dentist, but by the prosthetist.

A TEXT-BOOK OF PATHOLOGY, edited by *E. T. Bell, M.D., Professor of Pathology in the University of Minnesota, Minneapolis, Minnesota*. 5th edition, enlarged and thoroughly revised. 862 pages; 448 engravings and 4 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$9.50.

The new "Text-Book of Pathology" gives a complete review of the field of general pathology. It is well organized with subject matter listed under headings grouped in a practical way for the general practitioner and for the medical student. It is not exhaustive in all subjects but gives the fundamental pathologic changes both gross and microscopic for a working basis for path-

ologic diagnosis. It is simple, concise, and clear, but like all textbooks of pathology there are minor variations in classification, such as diseases of the kidney, which do not conform to Fishberg's classification. However for anyone wanting reference to clarify the basic pathologic pictures it is quite sufficient in its scope.

It might be added that there is a statement in the discussion of malaria that has not been verified in the reviewer's experience in the many cases of malaria seen in the tropics nor is it verified in other literature, i.e., that there are two varieties of *Plasmodium falciparum*, one maturing in 48 hours and the other in 72 hours. To the reviewer's knowledge there is only one type, manifested either by low-grade fever with the usual symptoms of malaria or by the typical full blown tertian fever occurring every 48 hours.

A good point in embryology which has been controversial in the past seems to be settled in Dr. Bell's discussion of the origin of the thyroid gland. It has been an established fact in the past that the thyroid gland originates mainly from the endoderm of the floor of the pharynx with contributions from the fifth pharyngeal pouch, which contributes portions to the lateral lobes. It seems to be borne out here that the floor of the pharynx would be the primary source of the thyroid gland, inasmuch as in 70 percent of the cases total excision of the lingual mass is followed by myxedema.

In summary, this book is a good practical textbook on pathology, with the exception of tropical diseases, which lack, in the Navy, is taken care of excellently by Stitt's two volumes.

REHABILITATION, RE-EDUCATION AND REMEDIAL EXERCISES, by *Olive F. Guthrie Smith, M.B.E., C.S.M.M.G., T.M.G., Principal of the Swedish Institute, London*; with a foreword by *Lord Horder, G.C.V.O., M.D., F.R.C.P.* 424 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$6.

This book, dedicated to those who are interested in physiotherapy, goes into much detail concerning mechanical equipment used in the execution of physiotherapeutic measures.

The book is well done and is thoroughly illustrated.

The rehabilitation, as dealt with in this discussion, is all physical in nature. Suspension therapy is given considerable space.

The special chapters are devoted to rehabilitation in fracture service, in chest service, in general service and in plastic surgery. Some chapters are written by outstanding authorities in each field.

The book admonishes all those dealing with rehabilitation to begin their program at the earliest practical moment while the patient is still bedridden.

The author, in a short comprehensive chapter, gives proof to the general belief that physiotherapy and occupational therapy are integral parts of physical medicine which plays such a major part in any rehabilitation program.

While this volume would make a good reference text, it is neither a complete text on rehabilitation nor on physical medicine.

PHARMACOLOGY, Oxford Medical Outline Series, by *Michael G. Mulinos, M.D., A.B., A.M., Ph.D.*, Associate Professor of Pharmacology, College of Physicians and Surgeons, Columbia University, New York, N. Y.; with a foreword by *Charles C. Lieb, A.B., M.D.*, Hosack Professor of Pharmacology, College of Physicians and Surgeons, Columbia University. 482 pages. The Oxford University Press, New York, publishers, 1944. Price \$4.

Following the general outline plan characteristic of the Oxford series, the present volume gives a comprehensive survey of the field of pharmacology.

Dividing the subject matter according to various systems of the human body, the pharmacology of drugs affecting those parts of the organism is discussed in surprising detail.

Despite its outline character the completeness of the text is noteworthy. Drugs of the latest discovery are included and the longest chapter of the book is devoted to chemotherapy. This emphasis on therapeutic application gives a practical aspect to the work, making it a valuable treatise on therapy. This feature alone recommends the book to the general practitioner as well as to the student of pharmacy.

SCABIES, Oxford War Manuals, by *Kenneth Mellanby, B.A. (Cantab.), Ph.D.*, Sorby Research Fellow of the Royal Society of London and Honorary Lecturer in Zoology in the University of Sheffield; general editor, *The Rt. Hon. Lord Horder, G.C.V.O.* 81 pages. Oxford University Press, New York, publishers, 1943. Price \$1.50.

This is an excellently written and very interesting book. It presents a complete and practical study of scabies.

The prophylaxis, diagnosis and treatment of the disease are especially well handled.

There are important practical points of the disease presented, with which it is probable most medical officers are not familiar. The volume will facilitate the diagnosis and treatment of the numerous cases of scabies encountered in the service.

HEALTH FOR THE HAVING, A Handbook for Physical Fitness, by *William R. P. Emerson, A.B., M.D.*, Professor of Pediatrics (Emeritus) Tufts College Medical School. 146 pages. The Macmillan Co., New York, publishers, 1944. Price \$1.75.

This timely book is a welcome addition to the literature of regu-

lated living for the general public during a time of emotional stress and worry.

Doctor Emerson recommends budgeting the day and adjusting one's regime of living to insure daily observance of the fundamentals of good health—sufficient fresh air and sunlight, good food and food habits, regular exercise and adequate rest. In order to achieve these essentials, five simple rules are given.

With the aid of Doctor Emerson's book, the person whose health has suffered through errors in daily living of which he may be unaware, can easily identify these faulty habits and correct them. Causes of overweight, underweight, nervous fatigue and numerous other conditions are outlined together with recommended measures for correction.

The appendix contains a table of 100-calorie portions of more than 200 food items, weight-height tables, and a chart on which the overweight or underweight may note weight losses or gains. The book is well indexed and so concise that after one hour's study the average individual will acquire a good idea of methods of increasing physical fitness.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

SULFA-MERCURY COMPOUND FOR VENEREAL PROPHYLAXIS

JAMES F. BLUTE, JR.

Lieutenant, junior grade (MC) U.S.N.R.

There are two problems in the prevention and treatment of venereal disease: (1) Prevention and prophylaxis; and (2) the care and treatment of the fully developed disease.

With the introduction of the sulfonamides and the demonstration of their efficacy in the treatment of cases of gonorrhea, the incidence of complications, the length of disability and time lost from work were all decreased. It seemed that the problem of treatment of gonococcal infections had been met. It was quickly discovered, however, that there was a high incidence of what were called "apparent" cures and of asymptomatic carriers. Also, as time went on, "five-day cures" of acute gonorrhea became less and less common. It was more usual for two or three or more courses of sulfonamide to be needed to effect a clinical and bacteriologic cure. To be cured in the first course of 20 or 25 gm. was exceptional. A single course failed to bring about a cure, apparently because staying in bed during treatment was not enforced. To enforce it would greatly increase the loss of man-days to the Navy and immobilize a large number of personnel. At sea, especially on smaller ships, it is important to have as few men as possible admitted to the sickbay. Such men are removed from their guns or other essential stations where they are necessary for the safety and efficient fighting needs of the ship, and become an added responsibility to Medical Department personnel during drills and alerts.

The use of penicillin, which has been given during a course of 24 to 30 hours, requires only a day or a day and a half away from duty. Like a sulfonamide, it can be given to ambulatory patients, but like the sulfonamides also, the results are then not so striking. The organisms and the exudate as well as the clinical symptoms disappear more slowly. Penicillin-treated patients should be ad-

vised to remain in bed during the course of treatment. The patient is seldom incapacitated for more than 36 hours.

REQUIREMENTS OF AN EFFECTIVE PROPHYLAXIS

An effective prophylaxis is the most logical and most efficient means of reducing the days lost by Naval personnel through venereal disease, especially gonorrhea. An effective prophylaxis is one that is: (1) Simple, requiring no elaborate or complicated apparatus to make or to administer; (2) easily available to both ships and shore establishments; (3) nonirritating and not painful or toxic; (4) effective in preventing disease. All these qualifications must be present. No one is more important than another. A drug may be the most powerful in the world in preventing disease, but it is not of value if it causes so much pain and irritation after its use that no one will use it; or if it is composed of rare or unavailable drugs; or if it cannot be easily made, stored and used in the limited facilities and cramped quarters aboard ships.

REPORT OF A SATISFACTORY PROPHYLACTIC SOLUTION

This communication is a report of the use of a prophylactic solution in a series of 80 consecutive cases aboard ship. The use of this prophylaxis was instituted when it became evident that the calomel and silver salts previously used were not protecting against gonorrhea. In the series of cases cited, not a single case of venereal disease appeared, although during the same period, 16 cases of gonorrhea, 3 cases of lymphogranuloma, and 1 case of syphilis had appeared in men who either took no prophylaxis or had used the calomel and silver method (table 1).

TABLE 1.—*Incidence of venereal diseases in 6-month period*

Disease	Total cases	Prophylaxis taken			
		None	Not known *	Silver and calomel	Sulfa-mercury
Gonorrhea	16	8	5	3	0
Lymphogranuloma venereum	3	0	2	1	0
Syphilis	1	0	0	1	0
Totals	20	8	7	5	0

* Men whose records had been transferred to other activities.

The solution was first used by Taylor¹ who reported satisfactory results in a group of 327 cases.

¹ TAYLOR, K. P. A.: Complete venereal prophylaxis with a sulfa-mercury compound. U. S. Nav. M. Bull. 41: 1488-1494, September 1943.

Formula.—It is made aboard ship according to the following formula:

Mercury oxycyanide	20
Sulfathiazole powder	10 00
Tragacanth	10 00
Water	225 00

The three powders are mixed and the water is added slowly by mixing with a spatula to a heavy creamy consistency which can easily be aspirated and ejected through a penile syringe. The amount of water needed will vary somewhat. The resulting emulsion, rather than solution, is kept in a jar and freshly prepared every month.

This prophylactic solution is simple to prepare and to administer. All the ingredients are listed in the Supply Catalog. If the solution is correctly given, as detailed in the accompanying table, there will be no local aftereffects. No systemic effects have ever been noted.

Method of administration.—1. In using the solution about 5 cc. is aspirated into a clean penile syringe and injected into the urethra.

2. The syringe is removed, the meatus closed by pinching between thumb and forefinger, and the contents are retained for 5 minutes by the clock.

3. At the end of this time the patient empties the urethra of as much of the material as he can, and the remainder is removed by a syringe of liquid petrolatum and by urination.

4. Complete removal of the solution is not effected by either urination or intra-urethral injection of saline solution. The use of mineral oil produces a coating on little globules of the solution, and thus removes it from prolonged intimate contact with the urethral mucosa and prevents the onset of urethritis.

5. About a gram of the solution is rubbed over the skin of the penis, scrotum, and thighs. The solution does not stain the clothing.

CHEMICAL URETHRITIS

It has been found that if the solution is left in the urethra for a longer period than 5 minutes, it sets up a violent and painful chemical urethritis. Relief can be obtained by intra-urethral applications of liquid petrolatum several times daily. The condition will clear up in 2 or 3 days, leaving no sequelae. It occurs in from 12 to 18 hours after application and is characterized by a mucoid and occasionally a blood-tinged epithelial discharge, pain in the glans, tenesmus, and pain and burning on urination.

This condition happened in several men who figured that if the solution worked well with only 5 minutes' retention, it ought to work better with several hours' retention.

It was also found that mild cases of chemical urethritis, lasting from 18 to 24 hours, occurred in men who had used material that was about 6 weeks old. Although Taylor stated that no deterioration occurred even after 3 months' storage, results have been better with an emulsion that is less than 4 weeks old.

SUMMARY AND CONCLUSIONS

1. An effective prophylaxis is described and the method of use is detailed.
2. In a series of 80 consecutive applications, no cases of gonorrhea appeared.
3. Nonambulatory sulfonamide or penicillin treatment of gonococcal infections is more effective than ambulatory treatment.
4. To be effective a prophylaxis must be simple, easily available, nonirritating, and reliable in preventing disease.
5. Fewer man-days will be lost by Naval personnel through a more efficient prophylaxis against venereal disease.



PHTHALYLSULFATHIAZOLE IN SURGERY OF THE COLON

Succinylsulfathiazole definitely alters the postoperative course of patients upon whom operations on the colon are performed. It has been demonstrated repeatedly that such patients experience a smooth postoperative course.

Phthalylsulfathiazole may, likewise, be used. Its administration may be advantageous in those instances where the patient has a diarrhea such as is encountered, not infrequently, in the presence of malignancies of the cecum and ascending colon, as well as in those cases when it is desirable to resort to purgation to clear the bowel.

Qualitatively the comparative effects of phthalylsulfathiazole and succinylsulfathiazole are quite similar, while quantitatively the former drug has approximately twice the antibacterial activity.—POTH, E. J., and ROSS, C. A.: Clinical use of phthalylsulfathiazole. *J. Lab. & Clin. Med.* 29: 785-808, August 1944.

Lab. No. 1001
J. H. 1001
old
diag.

EPIDEMIC OF FOOD INFECTION CAUSED BY SALMONELLA MONTEVIDEO

WILLIAM A. MYERS
Lieutenant Commander (MC) U.S.N.R.
and
LUCIUS E. ECKLES
Lieutenant Commander (MC) U.S.N.R.

An epidemic of *Salmonella montevideo* food infection occurring in a population of 3,474 men of whom 975 became ill is herein reported because of the large number of men involved and because of the unusual causative organism.

The outbreak occurred in July 1943 in a colored regiment of recruits at a U. S. Naval training station. Each regiment has its own dispensary and galley, and the recruits ordinarily do not leave this area during their period of elementary training.

The first men began to report to the dispensary at about 1000 and continued to report for the next 24 hours, with the peak at about 2000. After the causative meal was established, it was found that the mean incubation time was 24 hours and the median was 23.6 hours. These figures were computed from 714 histories.

CLINICAL PICTURE

Symptoms.—The symptoms in 416 cases in which the histories were thought reliable were diarrhea and cramps (52.6 percent); headache (44 percent); nausea and vomiting (4.3 percent), and dizziness (6 percent). The mean temperature on admission was 101.9° F. Later in the course of the illnesses, temperatures as high as 104.5° F. were recorded. There was no disproportion between the pulse rate and the temperature. Headache was the first and most persistent symptom. The diarrhea, nausea, and vomiting were not severe, and there was no evident dehydration. No eye signs were noted. There were moderate generalized abdominal tenderness and some stiffness and soreness of the neck muscles. The complaint of dizziness was difficult to evaluate as it is common among colored recruits.

Treatment.—Treatment was based entirely on symptoms. Bed rest, oral fluids, light diet, and a bismuth opium mixture were used to check diarrhea.

Relapses.—Among the men affected in the epidemic a few had residual symptoms or questionable relapses. On the seventh, eighth, and ninth days after the ingestion of the questionable food, 17 men were seen—all complaining of fever, headache, pain in the neck region, and chills. All 17 had been previously ill, and 14 of them had been previously admitted to and discharged from either outlying sickbays or hospitals. These men were all admitted as bed patients and studied. The course was characterized by a lack of general complaints and a spiking afternoon fever (from 101° to 104° F.). The leukocyte count varied from 5,400 to 7,500 with a relatively high monocyte count (from 6 percent to 14 percent). Urine cultures were uniformly negative. One man whose chief complaints were abdominal pain and fever (100° F.), symptoms which subsided entirely within 48 hours, was found to have a positive stool culture for *S. montevideo* on the twelfth day. All but 3 of the 17 were discharged to active duty within a week.

As a precautionary measure all the men previously discharged from sickbays, dispensary, or hospital were examined and questioned 9 days after the epidemic onset. Fifty-two were found to have temperatures of 100° F. or higher. These men were observed in sickbays for 1 or 2 days. It was thought that the fever resulted from the regular courses of immunizations given during the preceding few days.

Severity of outbreak.—All patients were discharged from the hospital and dispensary within 96 hours, 90 percent being discharged within 48 hours. There were no deaths, and none of the patients was considered critically ill.

BACTERIOLOGY

S. montevideo was isolated in pure culture from the stools of ten ill men. The identification of the salmonella was made by the Station Bacteriology Laboratory and the Epidemiology Department, Naval Medical School, National Naval Medical Center, Bethesda, Maryland, and checked by the laboratory of the Fifth Service Command, U. S. Army.

According to Hormaeche and others (1) (2) the organism was first isolated in Uruguay from the lymph nodes of healthy swine and was later found by the same authors to be associated with certain cases of summer diarrhea in infants. The authors recognized the organism as a member of the VI, VII group, with flagellar antigens related to those of *S. enteritidis* and *S. senftenberg*, without being identical with either of them. In

an earlier article, Hormaeche and Peluffo (3) suggested heat-labile structure of gmsz (1) z (2)—. Kauffmann (4) states that it is possible to remove all agglutinins from *S. montevidео* serum with *S. senftenberg* (containing also the factor t besides gs, according to his newer conception) and *S. enteritidis* [gomz (1) z (2)] antigen, and proposed a simplified formula, VI, VII, gms:— for *S. montevidео*.

It has been found also in stools of chicks (5) and human beings (6). The greatest animal reservoir of *S. montevidео* in the United States is probably in domestic fowls (7). Edwards and Bruner (8) have found it in 17 out of 325 food poisoning outbreaks in man in the United States and its possessions between 1934 and 1941. Reference to only one other case was found in the literature (9).

The mode of transmission is the same as for *E. typhosa*.

EPIDEMIOLOGIC DATA

Determination of contaminated meal.—Whereas each recruit ate all three meals of the previous day, a group of officers and chief petty officers ate various meals or combinations of meals as listed in table 1, which established the noon meal of the day before the outbreak as the source of the infection.

TABLE 1.—Officers and chief petty officers who ate noon meal

	Total number	Number becoming ill	Percent becoming ill
Ate only noon meal.....	22	19	86.4
Ate three meals.....	10	8	80.0
Ate breakfast and noon meal.....	4	3	75.0
Total of men eating the noon meal.....	36	30	83.3
Total of men not eating the noon meal.....	9	0	0.0

The correlation between eating the noon meal and becoming ill was definite. (Chi squared = 22.5. $P = 0.0001$.) In other words, the possibility of chance occurrence was less than 1 in 10,000.

About 975 (28 percent) out of 3,474 men who ate the noon meal became ill.

The food served at each of the three chow periods was involved, although the percentage of men becoming ill after eating was greater in each succeeding period.

Each galley supplies eight mess halls, and each mess hall has its own steam table. By tabulating the number of ill men who obtained food from various steam tables, it was shown that no one table was indicated, and, therefore, the food was infected during the original preparation.

TABLE 2.—*Number of men who became ill eating at various times midday*

Time of meal	Total number men eating meal	Number becoming ill	Percent of total becoming ill
1030.....	418	37	8.8
1130.....	1321	234	17.7
1230.....	1699	474	27.8

Of the men who became ill, 112 gave accurate histories of the food eaten the previous 24 hours. From this data it was concluded that all foods except steak, gravy, peas, and potatoes could

TABLE 3.—*Relation between number fed and number ill*

Mess hall	Number of men fed	Number of ill men	Percent of ill men
8.....	259	28	10.8
7.....	410	139	33.9
6.....	392	106	26.8
5.....	355	43	7.8
4.....	760	234	31.2
2.....	559	149	26.7
1.....	522	113	21.7

be eliminated as the source of infection. None of the foods served was available for testing.

TABLE 4.—*Menu of noon meal*

Hot soup Steak in casserole Persillade potatoes Peas Lettuce salad, French dressing	Melon or apricots Bread Chilled tomato juice Sliced luncheon meat for 100 men instead of steak
---	---

PREPARATION OF SUSPECTED FOODS

Steak in casserole.—The beef was slightly browned on the grill at 0800, then placed in 150-gallon copper kettles and boiled with vegetable gravy. It was simmered until served. The gravy was prepared between 0730 and 0800 of hot bacon grease with additions of flour, milk, carrots, celery, and green peppers.

Luncheon meat.—The luncheon meat was a boiled ham mixture, sliced and added to the gravy and served at 1220 when the supply of steak had been consumed.

Persillade potatoes.—The potatoes were diced, boiled for 40 minutes, and a thin butter sauce with chopped parsley poured over them when served. The sauce contained flour and milk.

Peas.—The cans were opened between 0730 and 0830 and the peas placed in a 150-gallon copper kettle, seasoned with salt, pepper, and butter, boiled, stirred four or five times, and then simmered until served. Two batches were prepared, some remaining

TABLE 5.—*Food eaten by men who became ill*

Food	Number of men who ate food (112)
Steak and gravy.....	109
Luncheon meat and gravy.....	2
Peas.....	106
Potatoes.....	100
Tomato juice.....	88
Salad.....	73
Melon.....	52
Apricots.....	53
Soup.....	18(?)

from the first batch when the second was added. The cans were inspected for bulging and foul odor, and nothing abnormal was noted. Two different brands of peas were used.

The acting chief cook stated that about 1400 on the day of the suspected meal he had examined some cooked peas that were left over from the noon meal. He found gas bubbles on the surface of the peas and noted a sour odor. The peas were thrown out immediately. The mess cooks who opened the cans of peas were questioned. Nothing unusual had been noted by them about the peas or the cans from which they came.

The Department of Agriculture checked 100,000 cans of peas on the station about 2 weeks after the epidemic, and of these, only ten cans were found to be bulging. The peas in these cans were harmless from the standpoint of human consumption. The station laboratory examined six cans of the peas bacteriologically, and no pathogenic bacteria were found.

None of the food served at the suspected meal had been served at previous meals, and none had been prepared more than 3 hours prior to the first servings.

SOURCE OF INFECTION

Although the particular meal and the causative pathogenic organism involved appeared evident, the specific food contaminated and the time and method of infection remained undetermined.

All ship's cooks and mess cooks were questioned carefully concerning personal illness which may have occurred concomitantly or just prior to the outbreak of the epidemic. One man, a mess cook, admitted symptoms of a gastro-enteric nature but afterward retracted the admission, possibly through fear of criticism. This man worked in the butcher shop and had helped with preparation of the gravy. It was stated that he had had a mild diarrhea for 3 or 4 days prior to the day of the preparation of the food. This illness had not made him sufficiently ill to cause him to report to the sickbay. He had entirely recovered when questioned the

day following the epidemic onset. Stool cultures were obtained of all cooks and mess cooks. These were uniformly negative.

Many points of routine were checked and found in order, such as inspection of the galley, ship's cooks, mess cooks, and food by medical and line officers on the day before the epidemic. The operation of mechanical dishwashers along with methods of handling and inspecting food were checked and found to be satisfactory.

The large copper kettles used to prepare the food in the galleys are heated with live steam which fills the free space lying between two copper layers that make up their walls. Experience has shown that to obtain killing temperatures for bacteria in the center of a mixture being cooked, frequent stirring is necessary. Laxity in stirring might lead to ideal incubation temperatures rather than killing temperatures in contaminated foods.

SUMMARY

1. A violent outbreak of food poisoning which affected 975 of 3,474 recruits in a single regiment of colored troops in a Naval training station was shown to be due to *Salmonella montevideo*.

2. The specific food involved, though not determined, was apparently contaminated early in its preparation. Steak in casserole, contaminated by a mess cook who had suffered from a mild diarrhea for several days prior to the general outbreak and who had helped prepare the meat gravy, and spoiled peas were two possibilities as sources of infection.

3. Treatment was entirely symptomatic.

4. There were no deaths and no serious complications.

REFERENCES

1. HORMAECHE, E., and SALSAMENDI, R.: Sobre la prescencia de salmonellas en los ganglios mesentéricos de cerdos normales. *Arch. urug. de med., cir. y. especialid* 9: 665-672, December 1936.
2. HORMAECHE, E.; PELUFFO, C. A.; and ALEPPO, P. L.: Report of Proceedings, Third Internat. Cong. for Microbiol., New York, 1939.
3. HORMAECHE, E., and PELUFFO, C. A.: *S. montevideo*; nuevo tipo de salmonella encontrado en el Uruguay (nota previa). *Arch. urug. de med., cir. y. especialid* 9: 673-676, December 1936.
4. KAUFFMANN, F.: *Salmonella-Probleme*. *Ztschr. f. Hyg. u. Infectiönskr.* 120: 177-197, 1937. Report of Proceedings, Third Internat. Cong. for Microbiol., New York, 1939. p. 837.
5. JUNGHER, E., and CLANCY, C. F.: Undescribed serotype of salmonella isolated from chicks. *J. Bacteriol.* 34: 240, August 1937.
6. Ibid.: Serologic types of *Salmonella* isolated from paratyphoid in chicks. *J. Infect. Dis.* 64: 1-17, January-February 1939.

7. HORMAECHÉ, E.; PELUFFO, C. A.; and Aleppo, P. L.: Report of Proceedings, Third Internat. Cong. for Microbiol., New York, 1939. p. 638.
8. EDWARDS, P. R., and BRUNER, D. W.: Occurrence and distribution of salmonella types in United States. *J. Infect. Dis.* 72: 58-67, January-February 1944.
9. SCHIFF, F., and SAPHRA, I.: Variety of types in human paratyphoid C infections. *J. Infect. Dis.* 66: 97-99, March-April 1940.



EFFECTS OF DDT POISONING

Microscopic examination was made of 117 animals of 9 different species after administration of DDT by inunction, by stomach tube, or by admixture in the diet. Although there were wide variations in sensitivity to the compound among the different individuals of a given species, the lesions caused were quite consistent throughout the different species.

On the higher dosage levels, with the animals surviving from 1 to several weeks, there was typically caused a moderate degree of central necrosis of the liver, or with the longer periods of survival a combination of central necrosis and reparative hypertrophy which can be labeled as a moderate subacute degeneration of the liver.

The thyroid often showed moderate colloid depletion, less often epithelial desquamation, and rarely epithelial hyperplasia.

Very slight to moderate focal necrosis of voluntary muscles occurred in about 20 percent of animals on the higher dosage levels.

Rare myocardial and adrenal lesions may be of significance. DDT caused no or insignificant effects on bone marrow, bone, testis, pancreas, and spleen. Renal lesions were slight and infrequent.

Because of the tremors of long duration produced by it, DDT would appear to be a promising experimental agent for the neurophysiologist.—NELSON, A. A.; DRAIZE, J. H.; WOODARD, G.; FITZHUGH, O. G.; SMITH, R. B., JR.; and CALVERY, H. O.: Histopathological changes following administration of DDT to several species of animals. *Pub. Health Rep.* 59: 1009-1020, August 4, 1944.

NOTES ON OUR RESERVE CONTRIBUTORS

Barnes, LaVerne A., Lieutenant Commander H-V(S) USNR (*Pathogenic Enteric Bacilli*, p. 939). B. S., 1925; M. S., 1928; Ph.D., 1929, State College of Washington. Demonstrator in bacteriology, Western Reserve School of Medicine, 1925-26; teaching fellow in bacteriology, State College of Washington, 1926-29; senior instructor in bacteriology, Western Reserve School of Medicine, 1929-31; senior bacteriologist, Massachusetts Department of Public Health, 1931-; assistant in preventive medicine, Harvard Medical School and School of Public Health, 1931-. Fellow American Public Health Association; member: Society of American Bacteriologists; American Association of Immunologists; Massachusetts Public Health Association. Coauthor, *Biology of Pneumococcus*, Commonwealth Fund, 1938.

Beneventi, Francis A., Lieutenant (MC) USNR (*Early Use of Sounds for Gonorrheal Urethritis*, p. 967). M.D., Long Island College of Medicine, 1930. Intern: St. Francis Hospital, Evanston, Ill., 1930-31; surgery, Fifth Avenue Hospital, New York City, 1931-32; surgeon: Passavant Memorial Hospital, Chicago, 1932-33; out-patient department, James Buchanan Brady Foundation of the New York Hospital, New York City, 1936-42; assistant attending urologist, New York Foundling Hospital, New York City, 1940-42; instructor in urology, New York Medical College, 1940-42; attending urologist: U. S. Marine Hospital No. 70, New York City, 1941-43; Manhattan Beach Hospital, United States Public Health Service, 1943. Fellow American Medical Association; member: Medical Society of the State of New York; New York County Medical Society; New York Branch, American Urological Association.

Blute, James F., Jr., Lieutenant, junior grade (MC) USNR (*Sulfa-Mercury Compound for Venereal Prophylaxis*, p. 1063). B.A., Boston College, 1938; M.D., Harvard Medical School, 1942. House officer, Third Medical Service, Boston City Hospital, Boston, Mass., 1942-43; medical staff (temporary appointment), Union Hospital, Fall River, Mass., 1943-.

Boyd, Greydon, G., Commander (MC) USNR (*Effects of Subtherapeutic Dose of Penicillin on Development of Primary Syphilitic Lesion*, p. 1034). A.B., 1925, and B.S., 1926, University of Missouri; M.D., Harvard Medical School, 1928. Intern, United States Naval Hospital, Chelsea, Mass., 1928-29; assistant surgeon, United States Naval Hospital, Portsmouth, N. H., 1929; intern: Doctors Hospital, New York City, 1930; New York Eye and Ear Infirmary, New York City, 1931-32; assistant surgeon, New York Eye and Ear Infirmary, 1934; private practice, New York City, 1934-41. Fellow American Academy of Ophthalmology, Otology, Laryngology and Rhinology; member Medical Society of the State of New York. Diplomate: National Board of Medical Examiners; American Board of Otolaryngology.

Cuttle, Tracy D., Lieutenant Commander (MC) USNR (*Medical Problems in Amphibious Warfare*, p. 922). A.B., University of California, 1931;

M.D., University of Pennsylvania, 1935. Exchange fellow in medicine. St. Bartholomew's Hospital, London, 1937-38; research fellow in medicine, Pennsylvania Hospital, 1938-40; assistant demonstrator in medicine, 1938-39, instructor in medicine, 1939-40, and demonstrator in medicine, 1940-41, Jefferson Medical College; assistant physician, chief of outpatient department, and assistant, cardiac clinic, Pennsylvania Hospital, 1941; assistant, diabetic clinic, Jefferson Hospital, 1939-41. Fellow: American Medical Association; Philadelphia College of Physicians; member: Philadelphia County Medical Society; Jefferson Society for Clinical Investigation; American Society of Clinical Research. Diplomate American Board of Internal Medicine.

Delaney, C. Joseph, Commander (MC) USNR (*Penicillin in Treatment of Human Bite Infections*, p. 1020). A.B., Boston College, 1924; M.D., Georgetown University School of Medicine, 1928. Intern, Bellevue Hospital, New York City, 1929-32; clinic instructor in surgery, New York University Medical School; associate surgeon, Bellevue Hospital, Knickerbocker Hospital and Willard Parker Hospital, New York City. Fellow: American College of Surgeons; New York Academy of Medicine; member New York State Medical Society.

Dennis, Robert L., Lieutenant Commander (MC) USNR (*Chemotherapy, Pyrotherapy and Penicillin in the Treatment of Gonorrhea*, p. 988). A.B., Stanford University, 1936; M.D., Stanford University School of Medicine, 1940. Resident pathologist, French Hospital, San Francisco, Calif., 1940-41; assistant resident in pathology, Stanford-Lane Hospital, San Francisco, 1940-41; assistant visiting pathologist, U. S. Veterans' Administration Facility, Fort Miley Hospital, 1940-41; instructor in advanced surgical pathology, department of pathology, Stanford University School of Medicine, 1940-41.

Douglas, Albert H. R., Lieutenant Commander (MC) USNR (*Penicillin in Pyrotherapy and Penicillin in the Treatment of Gonorrhea*, p. 988). A.B. York, 1925; M.D., Cornell University Medical College, 1929. Intern, Jewish Hospital, Brooklyn, 1929-31; adjunct cardiologist, chief of cardiac clinic and lecturer in medicine at nurses' training school, Jewish Hospital, Brooklyn, 1936-; associate visiting physician, Queens General Hospital, Jamaica, N. Y., 1941-. Fellow: American College of Physicians; American Medical Association; member Queens County Medical Society (secretary and chairman of section on internal medicine, 1940-42). Diplomate American Board of Internal Medicine.

Dunning, James M., Lieutenant (DC) USNR (*The Dental Status of Midshipmen*, p. 895). A.B., Harvard College, 1926; D.D.S., School of Dental and Oral Surgery, Columbia University, 1930. Dentist, Grenfell Labrador Mission, summers 1930 and 1932; private practice, New York City, 1930-; instructor in dentistry, School of Dental and Oral Surgery, Columbia University, 1930-35; dental director, Metropolitan Life Insurance Co., 1935-. Fellow: American College of Dentists; New York Academy of Dentistry; member: First District Dental Society, New York; American Association of Industrial Dentists.

Eckles, Lucius E., Lieutenant Commander (MC) USNR (*Epidemic of Food Infection Caused by Salmonella Montevideo*, p. 1067). A.B., University of Kansas, 1927; M.D., Harvard Medical School, 1931. Intern, 1931-33, and

resident in pediatrics and communicable diseases, 1933-35, Children's Hospital, Boston, Mass; teaching assistant in pediatrics and communicable diseases, Harvard Medical School and Harvard School of Public Health, 1934-35. Fellow American Medical Association; member: Kansas Medical Society; Shawnee County Medical Society. Diplomate American Board of Pediatrics. Associate editor, Journal of the Kansas Medical Society, 1938-43.

Ferguson, L. Kraeer, Captain (MC) USNR (*Agranulocytosis Treated with Penicillin*, p. 1014). M.D., University of Pennsylvania School of Medicine, 1923. Fellow in surgery, Hospital of the University of Pennsylvania, 1923-25; year's study in Europe, 1928-29. Private practice, Philadelphia, 1925-; assistant surgeon, Hospital of the University of Pennsylvania, Philadelphia; assistant professor of surgery, University of Pennsylvania School of Medicine; surgeon, Student Health Service, University of Pennsylvania; chief of the proctologic clinic, Hospital of the University of Pennsylvania and Philadelphia General Hospital; proctologist, Policemen and Firemen of Philadelphia; chief of the industrial clinic, Hospital of the University of Pennsylvania. Fellow: American College of Surgeons; American Medical Association; member: Philadelphia Academy of Surgery; American Surgical Association; American Gastro-Enterological Association; Physiological Society, Philadelphia; American Society for Experimental Pathology. Diplomate American Board of Surgery. Author, *Surgery of the Ambulatory Patient*, 1942; coauthor, *Surgical Nursing*, 6th edition, 1940; surgical editor, *Digest of Treatment*.

Fink, Harold, Lieutenant Commander (MC) USNR (*Penicillin in Malignant Granulocytopenia*, p. 1017). A.B., Columbia University, 1923; M.D., Long Island College of Medicine, 1926. Intern, 1926-28, assistant attending physician, 1928-31, staff, department of pathology, 1928-32, Jewish Hospital, Brooklyn, N. Y.; attending pathologist; Coney Island Hospital, 1931-; Harbor Hospital, Brooklyn, 1932-; Madison Park Hospital, Brooklyn, 1941-; instructor in pathology, Long Island College of Medicine, 1931-37. Fellow: American College of Physicians; American Medical Association; member: Kings County Medical Society; Medical Society of the State of New York; New York Pathological Society; New York State Society of Pathologists; American Association of Pathologists and Bacteriologists. Diplomate American Board of Pathology.

Fleming, Justus M., Commander (MC) USNR (*Safety Lock for Folding Field Operating Table*, p. 1047). B.S., Dartmouth College, 1921; M.D., University of Michigan Medical School, 1929. Intern, Blodgett Memorial Hospital, Grand Rapids, Mich., 1929-30; private practice, Elkhart, Ind., 12 years; staff, 1931-42, and chief of staff, 1942, Elkhart General Hospital. Fellow American Medical Association.

Foote, John J., Lieutenant (MC) USNR (*Refrigeration of Wounded Extremities*, p. 1041). A.B., Harvard College, 1934; M.D., Harvard Medical School, 1938. Intern: Mercy Hospital, Springfield, Mass., 1938-39; French Hospital, New York City, 1939-41; resident in gynecology, Harlem Hospital, New York City, 1941-42; resident in surgery, Lenox Hill Hospital, New York City, 1942-43.

Gouze, Frank J., Lieutenant Commander (MC) USNR (*Air embolism in Immersion Blast*, p. 871). B.S., St. Edward's University, Austin, Texas,

1936; M.D., University of Minnesota Medical School, 1940. Intern, St. Mary's Hospital, Duluth, 1940-41; fellow in internal medicine, Minneapolis General Hospital, Minneapolis, Minn., 1941-. Fellow American Medical Association.

Hamm, William G., Commander (MC) USNR (*Penicillin Therapy in Phagedenic Ulcer (Tropical Sloughing Phagedena)*, p. 981). B.S., University of Georgia, 1921; M.D., Washington University School of Medicine, 1925. Intern, assistant resident, and resident surgeon, Barnes Hospital, St. Louis, Mo., 1925-30; associate in surgery, 1939, Emory University School of Medicine. Fellow: American College of Surgeons; American Medical Association; member: Southern Surgical Association; American Association of Plastic Surgeons; Society of University Surgeons; Medical Association of Georgia. Diplomate: American Board of Surgery; American Board of Plastic Surgery; National Board of Medical Examiners.

Hewson, George F., Lieutenant (MC) USNR (*Effects of Subtherapeutic Dose of Penicillin on Development of Primary Syphilitic Lesion*, p. 1034). B.S., St. Louis University, 1931; M.D., St. Louis University School of Medicine, 1933. Intern, Newark City Hospital, Newark, N. J., 1933-35; assistant in surgery, New York University; assistant surgeon: Newark City Hospital, Presbyterian Hospital, St. Michael's Hospital and Babies' Hospital-Coit Memorial, Newark, 1935-42; chief, peripheral vascular clinic, St. Michael's Hospital; associate, peripheral vascular clinic, Presbyterian Hospital. Fellow: American Medical Association; American College of Surgeons.

Johnson, Paul A. G., Commander (MC) USNR (*Filariasis*, p. 950). B.S., University of Kansas, 1925; M.D., University of Kansas School of Medicine, 1927. Intern, Western Pennsylvania Hospital, Pittsburgh, Pa., 1927-28; resident in medicine, Neurological Hospital, Kansas City, Mo., 1928-33; private practice, Kansas City, Mo., 1933-41; attending physician: St. Joseph Hospital, 1938-41; Research Hospital, Kansas City, 1938-41; Independence Sanitarium and Hospital, Independence, Mo., 1934-41. Fellow American Medical Association; member: Jackson County Medical Society; Missouri State Medical Association; Kansas City Academy of Medicine; American Heart Association.

Kanof, Abram, Lieutenant Commander (MC) USNR (*Complications Following Tattooing*, p. 889). M.D., Long Island College of Medicine, 1928. Intern: medicine, Long Island College Hospital, Brooklyn, N. Y., 1928-29; pediatrics, Jewish Hospital, Brooklyn, 1929-31; Kingston Avenue Hospital, Brooklyn, 1931; adjunct pediatrician, Jewish Hospital. Fellow American Medical Association; member: Brooklyn Academy of Pediatrics; Kings County Medical Society; Society for Investigative Dermatology; American Academy of Pediatrics. Diplomate American Board of Pediatrics.

Kern, Richard A., Captain (MC) USNR (*Liver Involvement in Malaria*, p. 847). A.B., University of Pennsylvania, 1910; M.D., University of Pennsylvania School of Medicine, 1914. Instructor, medicine, University of Pennsylvania, 1916-21; associate, University of Pennsylvania School of Medicine and Graduate School of Medicine, 1921-28; assistant professor, 1928-34; professor, clinical medicine, 1934-; assistant chief of medical service, University Hospital. Fellow American College of Physicians; member: American Medical Association; Association of American Physicians;

American Society for Clinical Investigation; Society for the Study of Asthma (president 1934); American Clinical and Climatological Association; American Association for the Study of Allergy (president 1931); College of Physicians of Philadelphia; Pathological Society of Philadelphia. Diplomate American Board of Internal Medicine.

Knapp, Arthur Alexander, Commander (MC) USNR (*Eyeglasses for Combat*, p. 964). M.D., University and Bellevue Hospital Medical College, 1926. Intern, ophthalmology, Presbyterian Hospital, New York City, 1929-31; assistant eye surgeon, New York Eye and Ear Infirmary; research ophthalmologist for several projects during 1931-38, Department of Pharmacology, Columbia University; assistant visiting eye surgeon to the hospital and ophthalmologist, Arthritis Clinic, Hospital for Special Surgery (formerly Hospital for Ruptured and Crippled); associate ophthalmologist, Montefiore Hospital for Chronic Diseases, 1931-40; director of eye service, Sing Sing Prison Hospital. Fellow: American College of Surgeons; New York Academy of Medicine; American Medical Association; member: Association for Research in Ophthalmology; New York County Medical Society; American Academy of Ophthalmology and Oto-Laryngology; New York Medical Society. Diplomate American Board of Ophthalmology.

Lofgren, Robert C., Lieutenant Commander (MC) USNR (*Yaws Treated with Penicillin*, p. 1025). B.A., University of Minnesota, 1934; M.D., University of Minnesota Medical School, 1938. Intern, Kings County Hospital, Brooklyn, N. Y., 1937-39; fellow in dermatology and syphilology, University of Pennsylvania, 1939-42; assistant instructor, 1939-40, and instructor, 1940-42, Department of Dermatology and Syphilology, University of Pennsylvania. Diplomate American Board of Dermatology and Syphilology.

Marquis, John N., Lieutenant Commander (MC) USNR (*Medical Problems in Amphibious Warfare*, p. 922). Ph. B., Yale University, 1926; M.D., University of Pennsylvania School of Medicine, 1931. Intern, Methodist Hospital, Philadelphia, 1931-32; voluntary assistant, Stadt Krankenhaus, Mannheim, Germany, 1932-33; assistant in surgery, Methodist Hospital, Philadelphia, 1933-35; surgeon, McClung Hospital, Richwood, W. Va., 1935-41; private practice, surgery, Richwood, W. Va., 1935-. Fellow: American College of Surgeons; American Medical Association; member West Virginia State Medical Society.

Menville, John G., Lieutenant Commander (MC) USNR (*Penicillin in Sulfonamide-Resistant Gonorrhea*, p. 997). B.S., Tulane University, 1928; M.D., Tulane University of Louisiana School of Medicine, 1930; M.S., University of Minnesota Medical School, 1936. Intern, Charity Hospital of New Orleans, 1930-31; surgical pathology, Bloodgood's Laboratory, Johns Hopkins Hospital, Baltimore, 1931-32; urology, Squier Urological Clinic, Medical Center, New York City, 1932-34; fellow in urology, Mayo Clinic, Rochester, Minn., 1934-36; instructor in urology, Tulane University of Louisiana School of Medicine; visiting surgeon (urology): Charity Hospital; Hotel Dieu, Sisters' Hospital; Touro Infirmary, New Orleans, 1936-42. Fellow: American College of Surgeons; American Medical Association; member: Orleans Parish Medical Society; Louisiana State Medical Society; Southern Medical Society; Louisiana Urological Society; Southeastern Branch of the American Urological Association; Southeastern Surgical Congress. Diplomate American Board of Urology.

- Meredith, William C.**, Lieutenant Commander (MC) USNR (*Penicillin in Malignant Granulocytopenia*, p. 1017). B.S., New York University, 1921; M.D., Yale University School of Medicine, 1927. Intern, 1927-29, and resident in medicine, 1929-30, Medical Center of Jersey City; assistant physician, arthritis clinic, Cornell Medical Center, 1931-35; attending physician and chief, arthritis clinic, New Rochelle Hospital, New Rochelle, N. Y., 1933-; attending physician, Grasslands Hospital, Valhalla, N. Y., 1935-. Fellow: American Medical Association; American College of Physicians; member: American Rheumatism Association; American Trudeau Association.
- Metcalf, Ralph J.**, Lieutenant Commander (MC) USNR (*Relapsing Malaria*, p. 859). B.S., University of Wisconsin, 1924; M.D., Columbia University College of Physicians and Surgeons, 1927. Intern, Orange Memorial Hospital, Orange, N. J., 1927-28; Brooklyn Methodist Hospital, Brooklyn, N. Y., 1928-29; staff, Susan B. Allen Memorial Hospital, El Dorado, Kan. Member Kansas Medical Society.
- Miller, L. Tate**, Commander (MC) USNR (*Cerebrospinal Fever Treated with Cisternal Administration of Penicillin*, p. 1023). B.L., David Lipscomb College, 1911; M.D. Vanderbilt University School of Medicine, 1915. Intern, Parkland City Hospital, Dallas, Tex., 1915-1916; private practice, Dallas, 1916-40; consultant gastroenterologist: Methodist Hospital and Baylor University Hospital, Dallas; executive staff, Medical Arts Hospital, Dallas; professor, clinical medicine, Baylor Medical College of Medicine. Fellow: American College of Physicians; American Medical Association; member: Texas State Medical Society; Dallas County Medical Society; Dallas Southern Clinical Society; Southern Medical Association; National Gastroenterological Association.
- Moore, Moore, Jr.**, Commander (MC) USNR (*Improvised Metal Pins for Skeletal Transfixion*, p. 1036). M.D., University of Tennessee College of Medicine, 1933. Intern: Gorgas Hospital, Ancon, C. Z., 1933-34; New York Hospital, N. Y., 1934-35, assistant resident in orthopedic surgery, University Hospital, Chicago, Ill., 1935; resident in orthopedic surgery, Children's Hospital, Los Angeles, Calif., 1936-37; assistant resident and resident in fractures, Presbyterian Hospital, Medical Center, New York City, 1937-38; assistant resident, Memorial Hospital for the Treatment of Cancer and Allied Diseases, 1939. Fellow: American College of Surgeons; American Medical Association.
- Mrazek, Charles**, Lieutenant (MC) USNR (*Wardroom Operating Table for Destroyers*, p. 1044). M.D., Loyola University School of Medicine, 1934. Intern, Hospital of St. Anthony de Padua, Chicago, Ill., 1934-36; surgeon, House of Correction Hospital, Chicago, 1936-43; private practice, Berwyn, Ill.; 1937-; clinical instructor in urology, Loyola University School of Medicine, 1941-; urological staff, Hospital of St. Anthony de Padua; Chicago State Hospital; visiting staff, St. Anne's Hospital, Chicago. Member: American Medical Association; Chicago Medical Society; Bohemian Medical Society.
- Myers, William A.**, Lieutenant Commander (MC) USNR (*Epidemic of Food Infection Caused by Salmonella Montevideo*, p. 1067). B.S., University of Pittsburgh; M.D., University of Pittsburgh School of Medicine, 1930. Intern, Allegheny General Hospital, Pittsburgh, 1930-31; resident, Children's Hospital, Pittsburgh, 1931-32. Fellow American Medical As-

sociation; member: York County Medical Society; Society for the Study of Asthma and Allied Conditions; American Public Health Association.

Norris, Robert F., Lieutenant Commander (MC) USNR (*Liver Involvement in Malaria*, p. 847). A.B., Princeton University, 1928; M.D., University of Pennsylvania School of Medicine, 1932. Intern, Pennsylvania Hospital, Philadelphia, 1932-34; assistant in pathology, Johns Hopkins University, 1934-35; assistant director, Ayer Clinical Laboratory, Pennsylvania Hospital, Philadelphia, 1935-41; assistant instructor in pathology and medicine, University of Pennsylvania, 1936-41. Fellow: American Medical Association; College of Physicians of Philadelphia; member: American Association of Pathologists and Bacteriologists; American Association for the Advancement of Science.

Ottaway, John P., Lieutenant Commander (MC) USNR (*Refrigeration of Wounded Extremities*, p. 1041). A.B., University of Michigan, 1928; M.D., University of Michigan Medical School, 1933. Intern: University Hospital, Ann Arbor, Mich., 1933-34; Long Island College Hospital, Brooklyn, N. Y., 1934-35; resident, Woman's Hospital, New York City, 1935-37; assistant surgeon, Harper Hospital, Detroit. Fellow American College of Surgeons; member: Wayne County Medical Society; Michigan State Medical Society; Michigan Society of Obstetricians and Gynecologists; Central Association of Obstetricians and Gynecologists. Diplomate American Board of Obstetrics and Gynecology.

Pardoll, Davis H., Lieutenant Commander (MC) USNR (*Chemotherapy, Pyrotherapy and Penicillin in the Treatment of Gonorrhea*, p. 988). M.D., Long Island College of Medicine, 1925. Intern: Lincoln Hospital, New York City, 1925-26; Michael Reese Hospital, Chicago; assistant professor of urology, Chicago Medical School; clinical assistant, Northwestern University; consulting urologist, Elgin State Hospital, Elgin, Ill. Fellow American Medical Association; member: Illinois State Medical Society; Chicago Medical Society; Chicago Urological Society; American Neisserian Society. Diplomate American Board of Urology.

Pizzi, Francis W., Lieutenant Commander (MC) USNR (*Subacute Bacterial Endocarditis Successfully Treated with Penicillin*, p. 1010). M.D., New York University College of Medicine, 1927. Intern, St. Michael's Hospital, Newark, N. J., June 1927-June 1928; private practice, Orange, N. J., 1928-43; chief of clinics, St. Michael's Hospital, Newark, N. J.; associate gynecologist, Presbyterian Hospital, Newark; assistant surgeon, St. Mary's Hospital, Orange, N. J. Fellow: American Medical Association; New Jersey State Academy of Medicine; member Essex County Medical Society.

Ricchiuti, Joseph F., Lieutenant (MC) USNR (*Penicillin Therapy in Gonorrhea with Associated Undiagnosed Early Syphilis*, p. 1031). M.D., Jefferson Medical College of Philadelphia, 1930. Resident in pathology, 1930-31, and intern, 1931-33, Jefferson Medical College Hospital, Philadelphia; private practice, Mahanoy City, Pa., 1933-38; clinical assistant, immunology, Jefferson Medical College Hospital, 1933-; chief, dermatology and allergy clinic, Pottsville Hospital, Pottsville, Pa., 1935-; graduate study, New York Skin and Cancer Hospital, New York City, 1938-40. Fellow American Medical Association; member: Pennsylvania Medical Society; Philadelphia Allergy Society; Philadelphia Dermatologic Society; American Academy of Allergy; American Academy of Dermatology and Syphilology.

Short, James J., Commander (MC) USNR (*Penicillin in the Treatment of Primary Atypical Pneumonia*, p. 974). M.D., University of Buffalo School of Medicine, 1918. Instructor: chemistry, New York Post-Graduate Medical School of Columbia University, 1918-20; medicine, College of Physicians and Surgeons, Columbia, 1921-23; instructor, associate, and assistant professor, New York Post-Graduate Medical School, Columbia, 1923-35; associate clinical professor of medicine, 1935-. Chief of medical clinic and associate attending physician, New York Post-Graduate Hospital; research director and associate director, Life Extension Examiners, New York; director medical service, Department of Correction Hospitals, New York; attending physician, Welfare Hospital for Chronic Diseases, New York. Fellow: American College of Physicians; American Medical Association; member: New York County and New York State medical societies. Diplomate American Board of Internal Medicine.

Sprague, Howard B., Captain (MC) USNR (*Agranulocytosis Treated with Penicillin*, p. 1014). A.B., Harvard College, 1918; M.D., Harvard Medical School, 1922. Intern, Massachusetts General Hospital, Boston, 1922-24; associate physician, Massachusetts General Hospital; instructor, courses for graduates, Harvard Medical School. Fellow: American College of Physicians; American Medical Association; member: Massachusetts Medical Society; American Clinical and Climatological Association; American Heart Association (secretary); New England Heart Association (president); International Association of Medical Museums. Diplomate American Board of Internal Medicine.

Stringer, John T., Lieutenant, junior grade H-V(S) USNR (*Medical Illustration*, p. 970). University of Maryland, 1937; University of Maryland School of Medicine and College of Physicians and Surgeons, 1938-40. Qualified in medical drawing, photography, and moulage, including moulage prosthesis. Director of medical arts department, Columbia Hospital, Milwaukee, Wisconsin; associate, Mount Sinai Hospital, Milwaukee. Certificate of merit, State Medical Society of Wisconsin; Gold Medal Award for exhibit, American Academy of Orthopedic Surgeons, 1943.

Sulzberger, Marion B., Commander (MC) USNR (*Complications Following Tattooing*, p. 889). B.S., Harvard University, 1916; B.M.Sc., Sorbonne, Paris, 1922; M.D., University Zurich, Switzerland, 1926. Assistant, University Clinic (dermatology and syphilology), Zurich, 1926-29; Breslau, 1929; instructor in dermatology, 1929-35, assistant professor in clinical dermatology, 1935-38, and assistant clinical professor in dermatology and syphilology, 1938-, associate attending dermatologist, 1935-38, attending dermatologist, 1938-, New York Post-Graduate Medical School and Hospital; associate attending dermatologist, Montefiore Hospital for Chronic Diseases, New York City, 1931-; director dermatology and syphilology department, 1934-38, and consultant in dermatology, 1938, French Hospital, New York City; visiting physician, Goldwater Memorial Hospital for Chronic Diseases, Welfare Island, New York City, 1941-; research associate in medicine, Cornell University Medical College, 1942-. Fellow: American Medical Association; New York Academy of Medicine; member: American Dermatological Association; American Academy of Dermatology and Syphilology; American Academy of Allergy; American Association of Immunologists; Bronx Dermatological Society; Society for Experimental Biology and Medicine; Society for Investigative Dermatology; Society for

Research in Psychosomatic Problems. Editor, Year Book of Dermatology and Syphilology, 1931-; Board of Editors, Journal of Allergy, Psychosomatic Medicine, Dermatologica; editor, Journal of Investigative Dermatology, 1938-. Author, Dermatologic Allergy, Charles C Thomas, 1938; coauthor, Dermatologic Therapy in General Practice, Year Book Publishers, 1940. 2d edition 1942; coauthor, Manual of Dermatology (Military Medical Manuals, National Research Council), W. B. Saunders, 1942.

Twiss, John R., Commander (MC) USNR (*Penicillin in Treatment of Rheumatic Fever and Gonococcal Infections*, p. 1001). A.B., Columbia University, 1921; M.D., Columbia University College of Physicians and Surgeons, 1924. Intern: St. Mary's Hospital for Children, New York City, 1924; New York Post-Graduate Medical School and Hospital, New York City, 1925-27; assistant physician, 1927-29, assistant attending physician, 1929-30, associate attending physician, 1930-31, and attending physician, 1932-36, dispensary, New York Post-Graduate Medical School and Hospital; assistant to hospital, 1934-36, and assistant attending physician, 1936, New York Post-Graduate Medical School and Hospital; assistant attending physician, Gouverneur Hospital, New York City, 1936; instructor in medicine, 1930-35, associate in medicine, 1935-36, and assistant clinical professor in medicine, New York Post-Graduate Medical School. Fellow: American College of Physicians; American Medical Association; member: New York County Medical Society; Medical Society of the State of New York; American Gastro-Enterological Association; International Gastro-Enterological Association. Diplomate American Board of Internal Medicine.

Ungar, John, Jr., Lieutenant (MC) USNR (*Relapsing Malaria*, p. 859). M.D., Jefferson Medical College of Philadelphia, 1932. Intern, Allegheny General Hospital, Pittsburgh, Pa., 1933; resident in pathology, Singer Memorial Research Laboratory, Pittsburgh, 1934; house physician, Allegheny General Hospital, 1935; Littaner Fellow, Harvard Cancer Commission, 1936; assistant pathologist, Singer Research Laboratory, 1937-38; pathologist; Butler County Memorial Hospital, Butler, Pa., 1939; Sewickley Valley Hospital, Sewickley, Pa., 1940-41. Fellow American Medical Association; member: Medical Society of the State of Pennsylvania; Clinical Pathological Society of Pittsburgh.

Wagner, Joseph A., Lieutenant Commander (MC) USNR (*Effects of Subtherapeutic Dose of Penicillin on Development of Primary Syphilitic Lesion*, p. 1034). B.S., Franklin and Marshall College 1934; M.D. University of Pennsylvania School of Medicine, 1938. Intern, 1938-1939, and resident in pathology, 1939-40, Bryn Mawr Hospital, Bryn Mawr, Pa.; Morris Stroud fellow in cardiology, Pennsylvania Hospital, Philadelphia, 1940-42; instructor in internal medicine University of Pennsylvania School of Medicine, 1941; assistant physician: Bryn Mawr Hospital, 1942; Pennsylvania Hospital, 1942.

Watkins, George Linn, Lieutenant, junior grade (MC) USNR (*Method for Individual Transportation of Plasma in the Field*, p. 1038). A.B., Westminster College, 1938; M.D., Washington University School of Medicine, St. Louis, 1942. Intern St. Louis City Hospital, St. Louis, Mo., June 1942-April 1943.

Webster, George V., Lieutenant Commander (MC) USNR (*Adherent Scars of the Lower Extremity*, p. 878). Stanford University, 1928-32;

M.D., Stanford University School of Medicine, 1937. Intern, surgery, Stanford-Lane University Hospital, 1936-37; assistant resident in surgery, 1937-38; assistant in pathology, Stanford University; assistant visiting pathologist, San Francisco Hospital, July 1938-January 1939; surgical house officer, Stanford-Lane University Hospital, January 1939-July 1939; junior resident in surgery, Presbyterian Hospital, New York City; assistant in surgery, Columbia University College of Physicians and Surgeons, July 1939-July 1940; resident in plastic and reconstruction surgery, Presbyterian Hospital, New York City, July 1940-January 1942. Diplomate American Board of Surgery.

White, Don Parle., Lieutenant (DC) USNR (*Preliminary Bite-Wing Roentgenographic Examination of Naval Aviation Cadets*, p. 901). D.D.S., College of Dentistry, University of California, 1936. Private practice, Berkeley, Calif., 1936-43; clinical assistant, division of dental medicine, College of Dentistry, University of California at San Francisco, 1936-43. Member: American Dental Association; California State Dental Association; Berkeley District Dental Society (secretary 1943).

Wildebush, Frank F., Commander (MC) USNR (*Hospital Ship in Amphibious Action*, p. 937). B.S., University of Iowa, 1924; M.D., University of Minnesota Medical School, 1928. Instructor, physiological chemistry, University of Minnesota, 1928-29; teaching fellow, Graduate School, University of Minnesota, 1929-32; private practice, Minneapolis, Minn., 1934-. Member Minnesota State Medical Association.

UNITED STATES
NAVAL
MEDICAL
BULLETIN



MONTHLY

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Compiled and published under the authority of
Naval Appropriation Act for fiscal year 1945,
Public Law No. 347, approved June 22, 1944

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1944

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.
See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3 and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5 and 6.

Volume 24, 1926, Nos. 1, 2 and 4.

Volume 25, 1927, Nos. 1 and 4.

Volume 26, 1928, Nos. 1, 3 and 4.

Volume 27, 1929, No. 4.

Volume 28, 1930, No. 1.

Volume 31, 1933, No. 3.

Volume 42, 1944, No. 2.

SUBSCRIPTION PRICE OF THE BULLETIN

Subscriptions should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Yearly subscription, \$4; foreign subscription, \$5.

Single number, domestic, 35 cents; foreign, 45 cents, which includes foreign postage.

Exchange of publications will be extended to medical scientific organizations, societies, laboratories, and journals. Communications on this subject should be addressed to the Surgeon General, United States Navy, Washington 25, D. C.

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions.

Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANDELL, *Editor,*
Commander, Medical Corps,
United States Naval Reserve, Retired.
STEPHEN A. ZIEMAN, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

TABLE OF CONTENTS

	PAGE
PREFACE	III
NOTICE TO CONTRIBUTORS	IV
SPECIAL ARTICLES	
Eye Replacement by Acrylic Maxillofacial Prosthesis—Phelps J. Murphey and Leon Schlossberg	1085
Tantalum in the Immediate Repair of Traumatic Skull Defects; Method of Immobilizing the Wounded Brain—W. James Gardner	1100
Traumatic Hemothorax—Joseph D. Cuono	1107
Achalasia in Military Service; Treatment and Disposition—Richard R. Hoffman	1111
Pterygium Transplantation by Simplified Method—Lycurgus M. Gurley, Jr.	1114
Cold Hemagglutination Test in Diagnosis of Primary Atypical Pneumonia—Arthur A. Humphrey	1117
The Cold Agglutination Test: I. Studies on Naval Hospital Patients; II. Studies on Natives in Yaws-Endemic Area—George H. Fetterman, Thomas J. Moran, and William R. Hess	1128
Mental Mechanisms and Morale Factors of Naval Recruits in Training—Crawford N. Baganz, Robert J. Mearin, and Walter A. Woods	1137
Dental Survey in the Marshall Islands—Frits A. S. Winblad	1141
The Dental Corps Comes of Age—Francis G. Ulen	1145
Cerebral Symptoms in Malaria—Sylvester McGinn and John T. B. Carmody	1157
Hippuric Acid Liver Function Test in Relation to Malaria and Atabrin—James K. McCorkle	1163
Acute Infective Jaundice and Acute Hepatitis—Maynard I. Cohen	1166
Observations on Malaria—Dana A. Weeks	1171
Pathogenic Enteric Bacilli: III. The Shigella Group—LaVerne A. Barnes	1178

	PAGE
Dermatologic Conditions Prevalent in Tropical Areas; Treatment with Heavy Dosage of Ultraviolet Ray—Kenneth Phillips and Victor B. Buhler	1193
Chemotherapy and X-ray Radiation in Treatment of Cellulitis of the Head and Neck—Samuel S. Wald	1200
Treatment of Skin Diseases on an Attack Transport; Use of Undecylenic Acid—Walter J. McCann	1205
Biostatistics in Medical Research: I. Significant Differences—H. M. C. Luykx	1208

CLINICAL NOTES

Congenital Choanal Atresia—Gilbert J. Roberts	1216
Periarteritis Nodosa; Report of a Case—Charles M. Thompson	1220
Daily Use of Benzedrine Sulfate Over a Period of Nine Years; Report of a Case—Henry J. Bakst	1228
Hemoglobinuria Following Plasmochin Therapy—Richard L. Thirlby ...	1232
Avulsion of Forearm; Report of a Case—Robert F. Legye	1236

MEDICAL AND SURGICAL DEVICES

Construction of a Contact Lens for Localization of Intraocular Foreign Bodies—William P. McGuire and Edward C. Raffetto	1239
Combination Shipboard Operating Table for General, Orthopedic and Urologic Surgery—Alton R. Higgins	1243
Improvised Donor Set for Giving Indirect Transfusions—Paul Peterson and Richard H. Ames	1251
Suggested Changes in Instrument for Adult Circumcision—John D. Hubbard and Forrest M. Brunson	1253
Canvas Bag for Life Raft First-Aid Kit—Burdick G. Clarke	1256

EDITORIALS

Acrylic Ocular Prosthesis	1258
Skin Diseases in the Tropics	1258
Cryptorchidism	1260

BOOK NOTICES

The Art and Science of Nutrition, Hawley—Elimination Diets and the Patient's Allergies, Rowe—Allergy in Practice, Feinberg, with the collaboration of Durham—Vascular Responses in the Extremities of Man
--

in Health and Disease, Abramson—Fractures and Joint Injuries, Watson-Jones—Hypertension, Page—The Principles and Practice of Medicine, Osler, rewritten by Christian—Clinical Urology, Lowsley and Kirwin—Intravenous Anesthesia, Adams—Rorschach's Test, Beck—Virus Diseases in Man, Animal and Plant, Seiffert—Tropical Nursing, Gregg—Notes on Nursing by a Nurse, Corry—Laboratory Methods of the United States Army, 25 contributors, edited by Simmons and Gentskow	1262
--	-------------

PREVENTIVE MEDICINE

Cadmium Poisoning; Report of Outbreak—Nathaniel H. Lufkin and Francis T. Hodges.....	1273
Food Infection; Septic Sore Throat Epidemic—Raymond H. Goodale and James G. Lambrakis.....	1277
Respiratory Diseases and Food Poisoning.....	1282
STATISTICS: Health of the Navy.....	1283
NOTES ON OUR RESERVE CONTRIBUTORS.....	1284
INDEX, Volume 43, Nos. 1 through 6 (July, August, September, October, November, and December 1944).....	1291

U. S. NAVAL MEDICAL BULLETIN

VOL. 43

DECEMBER 1944

No. 6

SPECIAL ARTICLES

EYE REPLACEMENT

BY ACRYLIC MAXILLOFACIAL PROSTHESIS

PHELPS J. MURPHEY

Lieutenant Commander (DC) U.S.N.R.

and

LEON SCHLOSSBERG

Lieutenant H-V(S) U.S.N.R.

The Naval dental officer, because of his background and training in denture prosthesis, together with the aid of a medical illustrator, is ideally equipped to cooperate with the medical officer in restoring lost portions of the face through maxillofacial prostheses.

Present war casualties have demonstrated the necessity for adequate eye replacements which will restore the normal contours of the face, be functional in their movement, accurate in duplication of color and light-reflecting properties, and yet satisfy esthetic requirements.

Most eye casualty patients immediately display their disfigurement, with the collapsed appearance of the eye socket revealing the extent or absence of the socket contents. Often eye replacements made with glass or acrylic resin are apt to be a source of extreme embarrassment and may retard the patient's rehabilitation because of the disheartening cosmetic results (1). Delay in return to limited military duty or to civilian life is often necessitated. Should the prosthesis not provide the essential qualities of an adequate restoration, its psychologic value will be destroyed. Figure 1 shows such an inadequate restoration. It is therefore imperative to devise a restoration which will incorporate the desired objectives. An individually made prosthesis will more nearly supply the requirements.

Eye casualties are referred from the eye department of the

Naval Hospital to the Naval Dental School at the National Naval Medical Center, Bethesda, Maryland. Each patient is first examined by the ophthalmologist to make sure that the eye socket is in excellent condition to receive the replacement before impressions are taken.

ANATOMIC CONSIDERATIONS

Since each eye socket presents a different structural and functional requirement, the existing muscle movements to be accommodated should first be studied. The degree of potential movement of the replacement will be determined by the lateral, oblique, and vertical movements of the existing muscle attachments in the walls of the socket.

A brief review of the muscles of the orbit shows that there are six extrinsic muscles of the eyeball, namely the four recti muscles—the superior, inferior, medial, and lateral; and the two oblique muscles—the superior and inferior. The recti muscles arise from a common tendinous ring, attached around the optic foramen, and as tendons pierce the fascial sheath, being inserted into the sclera and attached in front of the equator of the eyeball. The superior oblique muscle arises from just above the margin of the optic foramen, and passes forward to form a narrow tendon at the anterior part of the orbit; this tendon passes through the fibrocartilaginous pulley attached to the roof of the orbit. From the pulley it passes downward and laterally to be inserted into the sclera between the superior and lateral recti. The inferior oblique muscle arises lateral to the nasolacrimal groove; it is a slender, narrow band which passes laterally and curves upward to be inserted into the sclera between the recti muscles, farther back than the superior oblique muscle.

The remnants of these muscles, created by the whole or partial eyeball enucleation or evisceration, determine the movement possible in the completed prosthesis. These muscle movements may be interpreted when studying a left eye socket. Should the opposite eye move to the left, the back wall of the socket will move forward on its medial half, and backward on its lateral half. This wall moves in the opposite direction in movements to the right.

The principal muscle to be accommodated is the levator palpebrae superioris, which lies beneath the roof of the orbit and covers the superior rectus muscle. It arises from the same point above and in front of the optic foramen, and passes forward to be inserted into the upper lid in a membranous expansion, posterior to fibers of the orbicularis oculi in the upper lid. When the patient looks down there is a very forceful retention action of this muscle, to-



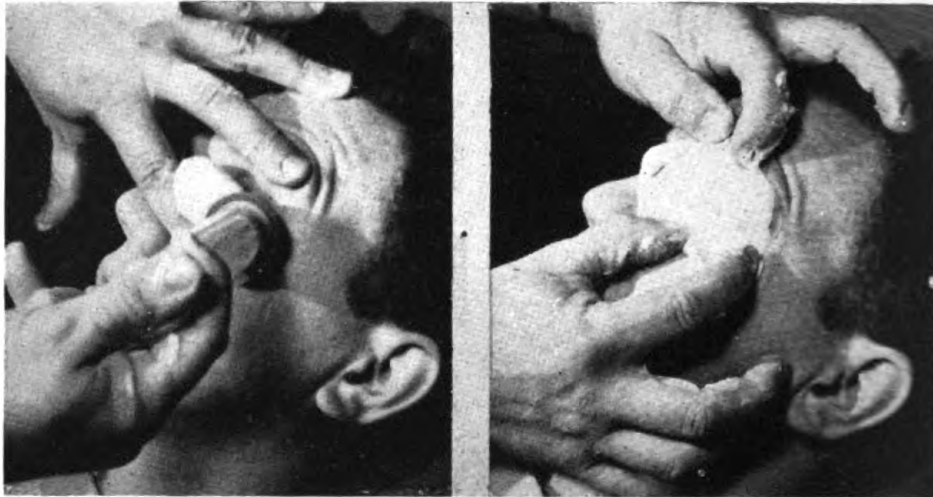
1. Esthetic requirements are not adequate. Normal contours of the face have not been restored.

gether with a forward expulsion action of the muscle segments remaining in the fascia of the back wall. These muscles must be accommodated by a concavity on the back portion of the prosthesis. If this is not taken into consideration, the replacement will flip out. In like manner the orbicularis oculi muscle fibers in the lower lid must be utilized to enable the patient to move the eye upward. This is done by building an extension on the lower margin of the prosthesis.

DUPLICATION OF THE EYE SOCKET

The first step in making the prosthesis, that of taking an impression of the eye socket, is expedited by a simple armamentarium planned for this particular prosthesis. It includes a plaster bowl and spatula, a thermometer, a beaker of water and one of cubed ice, and a tube of a hydrocolloid or alginate impression material with measuring cup and scissors. To provide an efficient method of injecting the impression material into the eye vestibule, a glass tube has been designed which terminates in a rubber nursing nipple, severed at the tip. This allows the material to flow in a rodlike pattern when pressure is applied on the glass plunger of the tube. Impression trays made of a clear acrylic resin distribute the material evenly over the eye area, and allow constant observation of the material while it is setting.

With these materials available, each step is carefully executed. When an alginate material is used, the temperature of the water is lowered to approximately 70° to 75° F. by the addition of the cubed ice. The water is then measured in the 55-cc. measuring cup and poured into the bowl. The end of the colloid tube is slit, and the retarder is removed and placed in the water to dissolve.



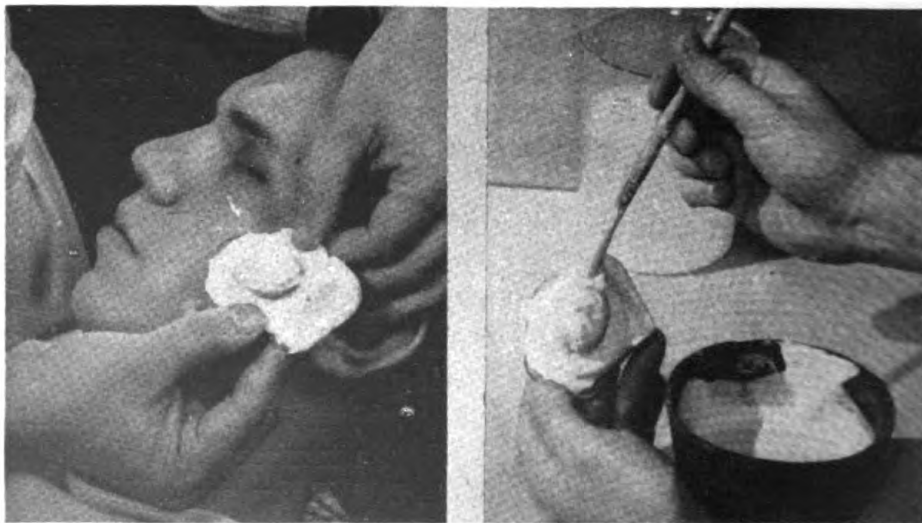
2. Glass tube injecting the impression material.

3. A transparent impression tray is held in position.

The impression powder is added, the mixture spatulated for 1 minute, inserted into the glass tube and the plunger replaced.

If a hydrocolloid material is used, it is prepared by heating in a water bath for 10 minutes. After cooling to a temperature that the tissues will tolerate, the end of the tube is slit, the contents are injected into the glass tube, and the plunger is replaced. The nipple end is then inserted into the patient's eye socket, and pressure is exerted on the plunger to expel the material, as shown in figure 2.

After the cavity is filled, the tube is carefully withdrawn, and the remaining material is spread over the external eye area. The impression tray is then placed over the material and pressure



4. The impression is checked for accuracy.

5. A stone working cast is poured.

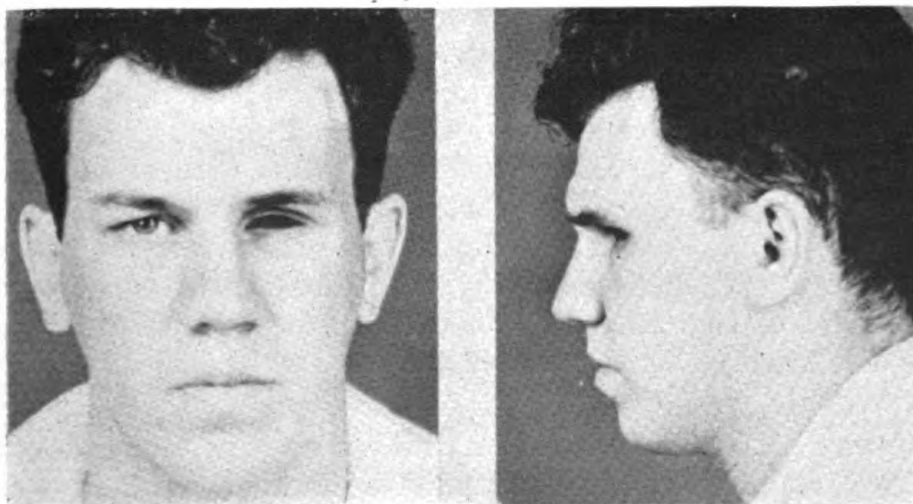
exerted further to confine the impression. The tray is held in place securely for 4 minutes to allow for hardening, as shown in figure 3.

After the impression material has hardened, the adjacent skin is gently pushed away from the material to facilitate removal of the impression. After removal (fig. 4), the negative reproduction may be checked for accuracy, afterward washing in running tap water to remove any eye secretions. The impression is surface-hardened or fixed by immersion in potassium sulfate solution for 15 minutes. A stone working cast is poured by carefully vibrating the stone mix over the impression, and pouring as for a denture base (fig. 5).

PHOTOGRAPHIC ORIENTATION

While the cast is hardening, photographs are taken of the eye area to provide a means of accurate measurement of the iris and pupil, and to facilitate registration of the palpebral or lid contours. Three drops of pontocaine hydrochloride administered by the physician will relax the eye for photography. A ruler held alongside the same plane of the existing eye enables an exact comparison to be made when another ruler is placed on the ground glass of the camera in a similar position. Thus an exact actual-size picture of the iris and pupil can be made.

Lateral profile views are also taken to determine the normal facial contour which should be restored, as well as to ascertain correct lid relaxation about the eye orifice. These photographs are relied upon to provide an accurate anatomic guide in the creation of the prosthetic counterpart (figs. 6 and 7).



6. Normal relaxation of the lid.

7. Normal facial contours to be restored.



8. The working cast is ready to receive the wax impression.

9. The completed wax model is smoothed down.

THE WAX PATTERN

The working cast, meanwhile, has hardened sufficiently to allow separation from the impression material. The cast is lubricated and a plaster lock is poured around it. The cast is then cut through vertically, to allow removal of the wax pattern from the undercut portions of the socket (fig. 8). Liquid petrolatum painted on the cast provides lubrication for the wax impression. One-fourth sheet of base-plate wax is adequate for the wax pattern. This is warmed over a slow flame and forced into the cast. Excess wax is removed and the impression chilled by immersion in ice water.

The wax pattern may now be safely removed from the cast and trimmed where necessary, or additional wax added in deficient areas until the pattern is adequate. Those lid areas to be emphasized may be added to, until the wax pattern reproduces the desired facial morphology. Extensions to the pattern may be made, even though they do not necessarily conform to the natural curvature of an eye. This is done to compensate for the loss of tissue in the orbit and of tone in the remaining muscle segments. These extensions are constructed on those portions of the prosthesis not visible after insertion (fig. 12). The completed wax model is smoothed, using a solution of equal parts of acetone and alcohol on a cotton pellet (fig. 9).

The wax pattern is dropped into ice water, removed, and lubricated with liquid petrolatum before trying in the eye socket. Additional carving or patterning may be done in order to adapt the pattern to the functions of the particular orifice. Lid reaction

should mimic the existing eye, and the profile view of the patient should duplicate the contour of the uninjured side.

When the results appear satisfactory, the wax pattern may be removed for duplication in an acrylic material. After investing with stone, and curing, the wax may be boiled out of the flask with hot water. While the flask is still hot, all surfaces are coated with an alginate material and allowed to dry, thereby providing for separation of the cured acrylic sclera.

COLORING

Obtaining the scleral color.—The medical illustrator, in the meantime, paints an exact reproduction of the scleral color of the patient's existing eye. This is used for matching the acrylic mix used in the scleral portion. A series of scleral colors have been cured in sample eye shapes, to arrive at the color after the material has been polymerized. These scleral colors are designated by number, depending on their color tints, and are similar to the shade guide used in the selection of porcelain teeth. These samples are prepared by measuring clear fluorescent acrylic material into a pint glass jar. To this is added titanium oxide in small quantities, to supply the desired whitish background, and the mixture is thoroughly stirred.

The basic colors, red, blue, and yellow, are added, bit by bit, in powder form and the mixture is spatulated. A small quantity of this mix is placed in a salve jar and to this is added the liquid monomer, drop by drop, until the powdered polymer is saturated to a degree of slight liquid excess. This sample is then cured in the typical scleral pattern. After polishing, it is compared with the color of the patient's sclera. This is best done by means of a sheet of black photographic paper into which two small apertures, about $\frac{1}{3}$ inch square, have been cut about $\frac{1}{4}$ inch apart. This furnishes an excellent mask, and will eliminate the influence of environmental color reflection while matching colors with the sample painted on the paper.

By holding the black mask about 10 inches from the patient's remaining eye, filling one of the square holes with white paper, and looking through the other square into the sclera, the difference in color may readily be seen and the color tint to be used determined. While colors are being matched the eye should be well illuminated by north daylight.

The sclera varies in individuals from a prominent blue to a yellowish green, and the color is not uniform, the area immediately around the iris being bluer than elsewhere. The blue blends into a

yellowish orange and then into a vermilion tinge. The change into the vermilion is due to the abundance of blood vessels in that region. Occasionally yellowish or whitish spots may be found. The area of the patient's sclera used to compare with the sample acrylic sclera is from $\frac{1}{8}$ to $\frac{1}{4}$ inch from the border of the iris, as this area is representative of the local scleral color. The other tints mentioned may be added to the cured acrylic sclera before the curing of the clear acrylic over the face of the prosthesis.

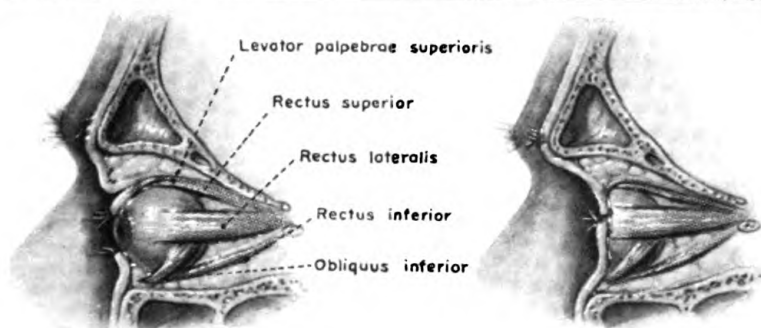
Curing the acrylic scleral portion.—After selecting the mix to be used a small quantity is measured into a salve jar and the liquid monomer added as before. The mix is allowed to become thoroughly saturated by closing the lid on the jar. When the mix does not stick to the spatula it is ready for packing. Cellophane sheets, previously soaked in water and wrung dry, are used to handle the puttylike mix. It is packed with moderate compression into the mold, and in excess to provide additional compression when it is trial-packed.

Two sheets of cellophane are placed between the halves of the flask before closure, after which it is placed in a flask clamp, applying moderate, steady pressure. The flask is then removed from the clamp and separated, the excess material being carefully removed with the spatula. Additional material should be added at this time provided an excess is not apparent. The case may be trial-packed again if necessary, or it may be finally closed without the cellophane and is then ready for curing.

Polymerization is accomplished by placing the flask in the clamp in tap water, and heating for 4 hours at 160° F. For the last 15 minutes of this period the water is kept at a steady boil. The case is then cooled in cold water for 15 minutes or allowed to cool on the bench. The flask may be carefully opened and the cured sclera cut from its investment for trimming and polishing. The excess may be removed by the usual vulcanite abrasive stones and cones, and at the same time the cornea may be additionally shaped to the desired form. This is then polished on the lathe with fine-grit flour of pumice. A felt cone is used, followed with a soft bristle brush at medium motor speed to prevent scratching, surface abrasion scorching, or distortion. A final high polish is given with a white rag wheel, at medium motor speed, using prepared chalk until the surface is smooth as glass and free from any artifacts or scratches.

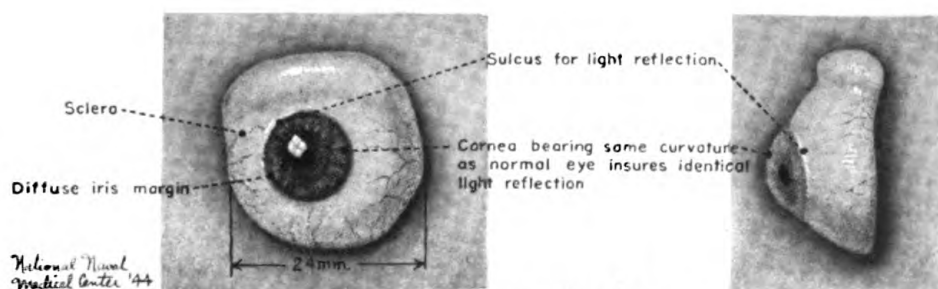
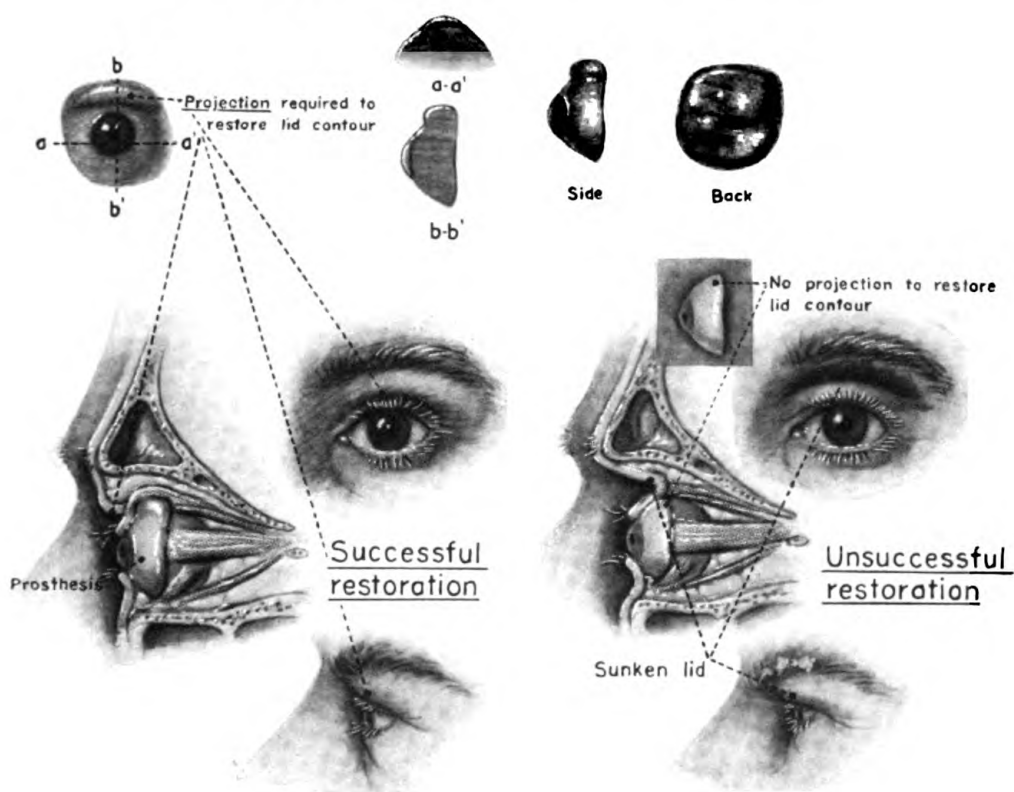
Painting the iris and pupil insert.—While the acrylic sclera is being polymerized, the medical illustrator studies the photographs, comparing them with the patient's iris, to determine the size of the iris to be painted. A millimeter in diameter is allowed for enlargement, because of the magnification produced by the clear acrylic

OCULAR REPLACEMENT BY ACRYLIC PROSTHESIS



Vertical section through orbital cavity

After evisceration



Actual size and coloring of prosthesis

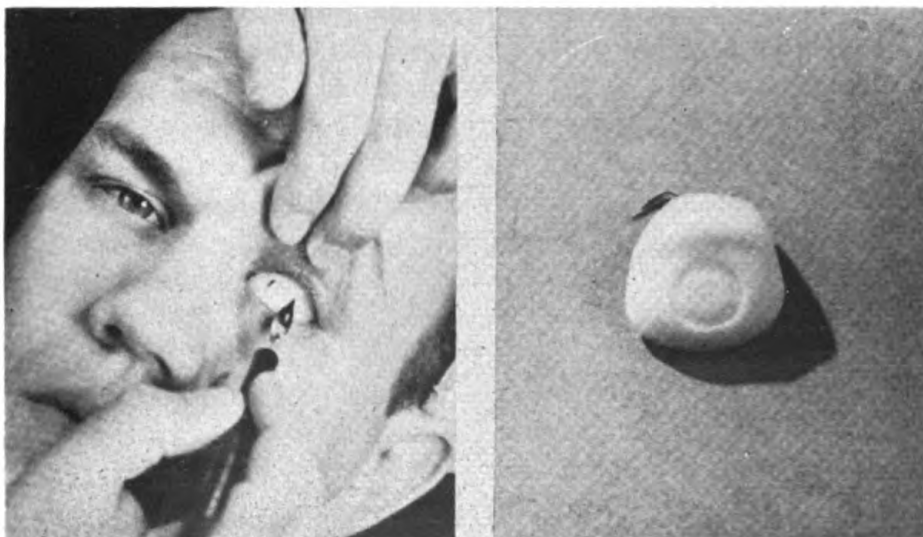
mass which will subsequently be cured over the painted iris.

The iris is first outlined with the compass in pencil, on a good quality of smooth, water-color paper. A small pupil is outlined for daytime wear, and a larger pupil for evening wear. An average size is usually drawn for both day and evening wear. The pupil is filled in with India ink, and the color around the pupil is mixed from the three primary colors, red, blue, and yellow. Lacquer colors have proved to be the most satisfactory. When the mixed color closely matches the iris color of the patient, a small dab is painted on a piece of paper and allowed to dry. This color is compared with the patient's iris by holding it up to the eye and comparing it through the black paper mask, as was done in matching the sclera.

More color is added as desired, the light areas are eliminated, lines radiating from the pupil are introduced as needed to emphasize detail, and specks of other colors, such as yellow or green, are spotted in to simulate the existing iris. This copy should be compared frequently with the natural iris with the aid of the black paper mask. Upon completion the painted iris is carefully cut from the paper, coated with clear lacquer, and a duplicate is made from white paper to be used while investing the sclera in the flask.

ORIENTATION OF THE IRIS

The polished sclera is placed in the eye socket, and eye movements, lid apertures, and physiologic restoration are again checked for accuracy. The exact location of the iris is marked on the face



10. The iris location is marked on the sclera.

11. The iris insert has been inlayed into the acrylic sclera.

of the sclera with etching ink (fig. 10). The eye portion is then removed and the iris location accentuated with ink. A mounted inverted cone is used to outline the undercut just within the line marked, and a small stone is used to flatten the areas, or provide a slight convexity to the surface within the cut circle. This inlay is 1 mm. below the surface of the face of the sclera.

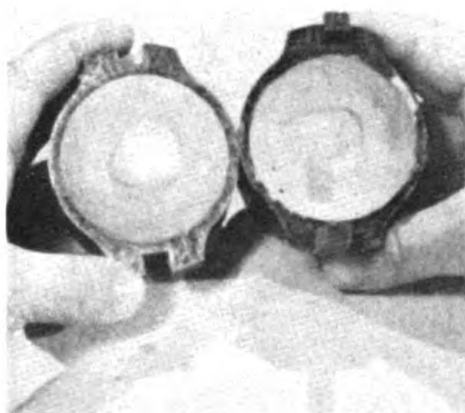
The paper pattern should tuck into the undercuts around the periphery of the circle, and should lie without buckling in an easy manner within the inlay. This is most important because it assures a pleasing, diffuse iris margin in the encompassing sclera. Should the inlay be larger than the iris, a noticeable line will betray the iris inlay around its margin and destroy the illusion of depth. With the paper pattern of the iris in the inlay, a stone is used to round off the buckled acrylic margins of the insert and blend them into the contours of the sclera. This also roughens the surface of the face of the sclera in order to receive the drawing in of blood vessels and tinted scleral areas.

POLYMERIZATION OF CLEAR ACRYLIC CORNEA AND SCLERA

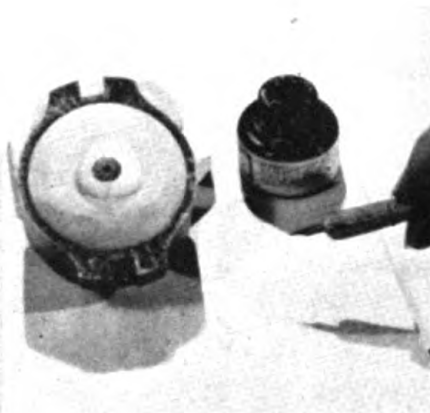
Plasticine is added to the face of the sclera and modeled in a dome shape over the iris area. Small portions of thin plasticine are added to the sides of the dome to create a small concave depression around the iris margin. This duplicates the anatomic concavity observed in the natural eye, which is termed the scleral sulcus. The orientation of the prosthesis may be obtained from sketches of the patient's eye, from the eye prosthesis, and from holding the prosthesis over the natural eye. This step is illustrated in figure 12, the color plate (2) on the opposite page.

The cornea, with sculptured plasticine is then invested in the brass flask, and after the stone has hardened, the flask is separated and the plasticine and paper pattern are removed (fig. 13). The medical illustrator then inserts the painted iris into the cut surface, and draws simulated blood vessels on the scleral surface with color-fast drafting inks, to match the patient's own sclera. These inks actually etch the scleral surface, and are preferable to colored threads because they are more realistic (fig. 14). Yellow, red, or blue tints, painted with lacquer, are also added at this time.

Clear fluorescent acrylic polymer is measured into a small crucible, using only about one-fourth the quantity used in the sclera, and this is placed in the mixing salve jar. The monomer liquid is added, drop by drop, until the powder is saturated to a slight liquid excess. This mixture is thoroughly spatulated, and the jar lid replaced to allow for additional saturation for from 5 to



13. The flask is separated and the plasticine and paper pattern have been removed.



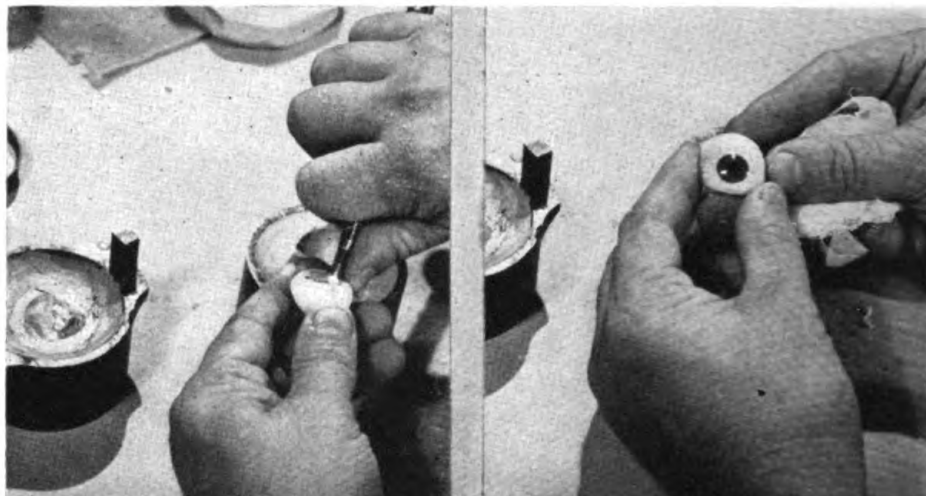
14. The painted iris has been inserted and the blood vessels have been drawn.

10 minutes. The top half of the flask is carefully tinfoiled over those areas which will be in contact with the clear acrylic when the flask is closed. As before, the mix is not used until it has the feel of putty and does not stick to the spatula. A small quantity is removed and handled with cellophane while packing it over the face of the painted iris and scleral areas and the upper half of the flask. Cellophane sheets are placed between the acrylic layers and the flask is closed and clamped in a flask clamp.

The flask is again opened, the cellophane removed, and the quantity of material checked. As before, the case may be trial-packed if required, or the final closure made for curing. The flask, still in the clamp, is placed in a tepid water bath and cured for 2 hours at 165° F.; again the water is brought to a rapid boil during the last 15 minutes of the cure. The flask is cooled, opened, and the prosthesis removed from its investment.

FINAL FINISHING AND DELIVERY

Mounted abrasive stones are first used to shape the clear acrylic portion of the prosthesis. It is then polished on the lathe with powdered pumice on felt cones and a soft bristle brush, and the final high polish is given with a rag wheel and prepared chalk. The iris is now visible through the clear acrylic. The center of the dome of the clear acrylic layer should be exactly over the center of the pupil, and it must be symmetrical in contour. With a small mounted stone the concave depression in the clear acrylic around



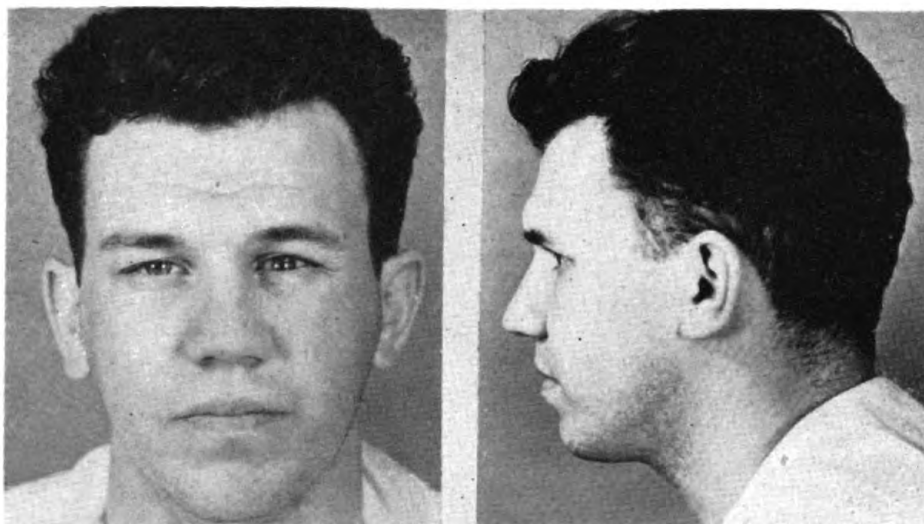
15. The scleral sulcus is accentuated by grinding with a mounted stone.

16. The completed prosthesis, ready for delivery to the patient.

the margin of the iris is accentuated by grinding (fig. 15). This step was postponed until this time because of the possibility of the clear acrylic distorting the indicated location of the iris.

The prosthesis is again taken to the lathe, and the soft-bristle brush wheel is used, with powdered pumice, to polish the bottom of the concave scleral sulcus at the periphery of the domed acrylic layer directly over the iris. This eliminates a continuity of light reflection from the iris area onto the scleral areas, and captures highlight reflections on the clear acrylic over the artificial iris similar to those of the natural eye. Any unusual light reflection may be corrected by grinding the surface of the clear acrylic layer to conform to the anatomic form of the remaining eye. Bars of light reflected from fluorescent light tubes may be exactly duplicated in the acrylic prosthesis to match light reflections in the natural eye. This important property of the acrylic material used should be utilized to create a replacement more desirable than previously employed prostheses (fig. 16).

The completed prosthesis is lubricated with clear mineral oil and inserted into the eye socket. The patient should wear the restoration for several hours, or overnight, before alterations are made, because the muscles and tissues of the orbit will compensate and adjust themselves to a considerable extent. At that time it may be necessary to grind high surface areas or repolish portions of the prosthesis. This type of prosthesis has the advantage that such adjustments may be made, and that it may be repolished if eye socket secretions etch the surface or it has been accidentally scratched or damaged.



17. The finished prosthesis in place.

18. Natural contours of the face are restored.

The many advantages of this acrylic ocular replacement may be seen by comparing the illustrations of a case before correction with those showing the eye prosthesis in position.

Other case presentations are illustrated on the following pages.

ADVANTAGES

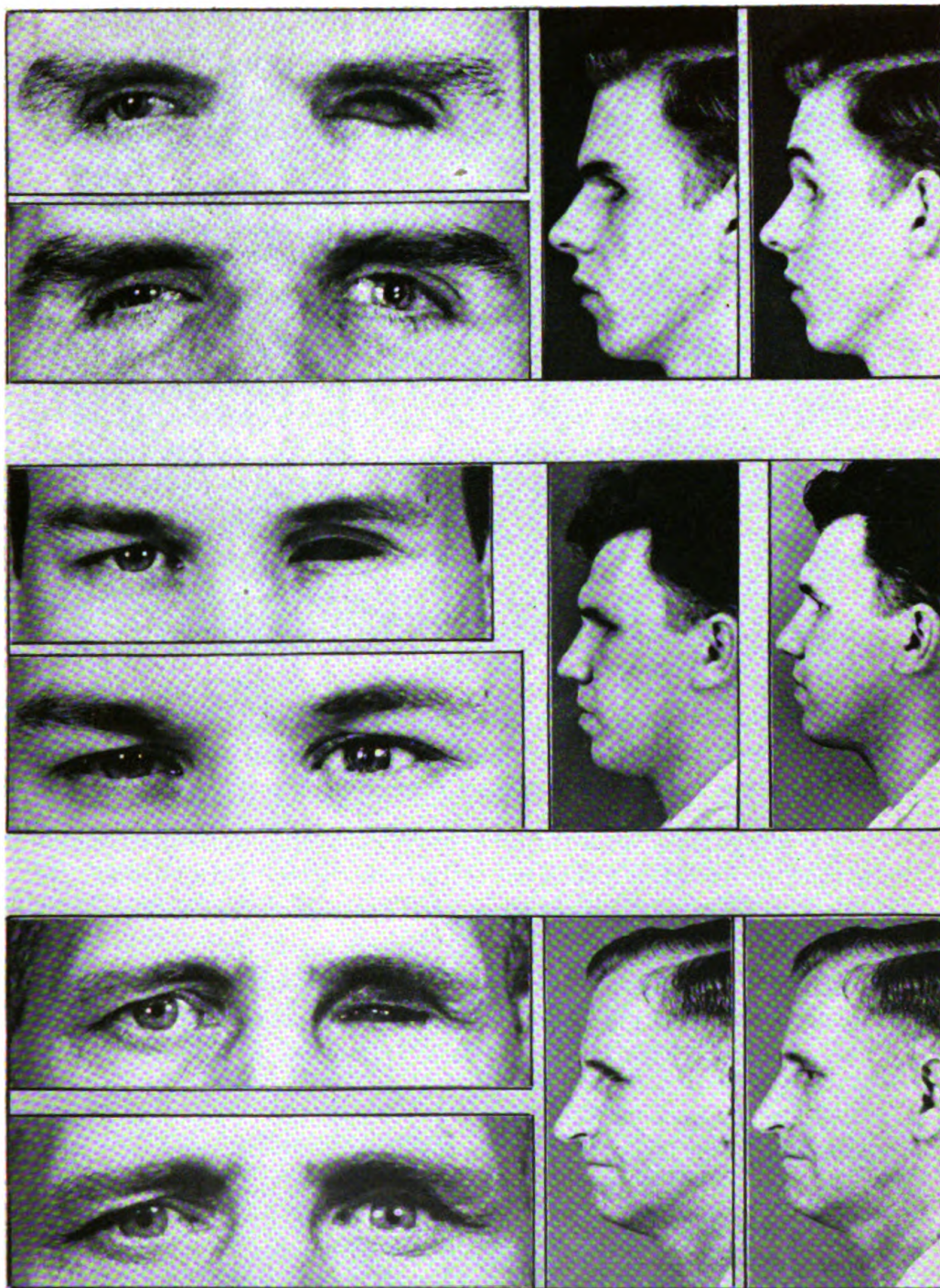
The advantages of making eye prostheses by the technic described may be summarized as follows:

1. The natural contours of the face before the eye was lost are restored in whole or in part.
2. The replacement, because it is adapted to muscle coordination, is capable of lateral, oblique and vertical movements of varying degree.
3. Light reflections may be accurately reproduced to simulate the existing eye.
4. Color matching or variation may be controlled to satisfy esthetic requirements.
5. When the prosthesis contacts the surfaces of the eye socket, it is capable of exerting a stimulating effect on orbital tissues, and of increasing the strength of the remaining eye muscle segments.
6. The acrylic material used is only slightly susceptible to etching from the eye socket fluids or secretions, and if scratched from handling, it may be repolished.
7. The acrylic prosthesis is resistant to usual accidental stresses, and if it is placed under extreme stress, a clean break can be repolymerized, or the entire eye readily duplicated.



19. Cases before and after receiving eye prostheses.

The fundamental technic suggested is familiar to the Naval dental officer. He may discover improvements or refinements in the basic technic as experience is acquired.



20. Cases before and after receiving eye prostheses.

REFERENCES

1. PENN, J.; BROWN, L. J.; BERRY, T. B.; SCHULMEISTER, A.; ROYLANCE, J.; and ORMEROD, C. L.: Problems in eyelid and socket reconstruction. Brenthurst Papers No. 4, April 1944. Brenthurst Red Cross Military Hospital for Plastic Surgery, Johannesburg, South Africa.
2. Adapted from SPALTEHOLTZ, W.: Atlas of Human Anatomy. Vol. 3. J. B. Lippincott Co., Philadelphia, 1937.

TANTALUM IN THE IMMEDIATE REPAIR OF TRAUMATIC SKULL DEFECTS

METHOD OF IMMOBILIZING THE WOUNDED BRAIN

W. JAMES GARDNER

Lieutenant Commander (MC) U.S.N.R.

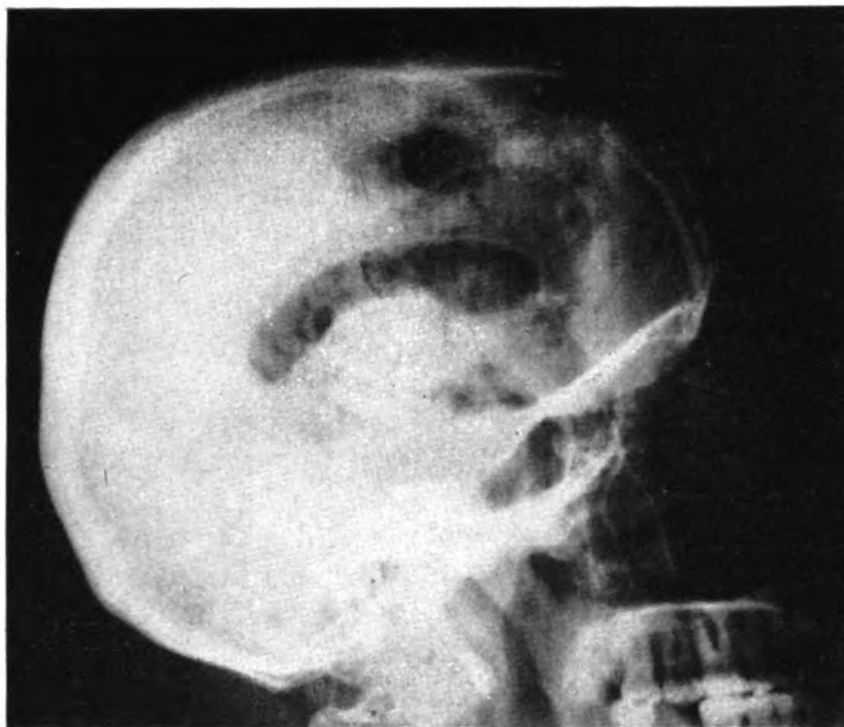
Immediate repair of a traumatic cranial defect has seldom been advocated because it is thought that the introduction of a plate or bone graft into a contaminated wound exposes the wound to infection. The accepted principles of treatment of a fresh craniocerebral wound are: Careful cleansing of the scalp; removal of devitalized tissue, bone fragments and accessible foreign material; hemostasis; and closure of the scalp wound over the cranial defect. Sulfanilamide is advocated for local application, and sulfadiazine orally administered is effective in the prevention of meningitis. If cranioplasty is indicated by the size or location of the defect, it is delayed for a period of months.

A consideration of principles involved and experience with two cases have convinced me that morbidity of brain wounds could be materially lessened by immediate repair of the skull defect.

In the literature on craniocerebral trauma little attention is given to cranial defects as a contributing cause of morbidity. This is doubtless due to the fact that the cranial defect is considered unavoidable, and perhaps actually beneficial in providing decompression to relieve the accompanying intracranial pressure. However a consideration of the dynamic factors involved reveals that the presence of a cranial defect is detrimental to the healing of a brain wound.

It is an established fact that within the intact cranial cavity the brain is a nonpulsating organ, whereas, within the trephined skull the brain pulsates with each change in arterial and venous pressure (1). Therefore, when the surgeon leaves a defect in the skull of any significant size, he transforms a nonpulsating organ into a pulsating one. Since immobilization of injured tissue is a recognized surgical procedure, it should be equally advantageous in injuries involving the brain.

The high incidence of epilepsy in patients recovering from penetrating wounds of the brain is well known. How many cases are attributable to the scar resulting from the passage of the missile and how many to the subsequent brain trauma occasioned by the



1. Encephalogram showing migration of anterior horn of ventricle toward site of an unrepaired cranial defect.

unrepaired cranial defect is debatable. It is significant that Grant and Norcross (2) found that 18 of 27 patients who had post-traumatic epilepsy coincident to cranial defects were benefited or cured by simple cranioplasty without excision of the underlying brain scar. It is not unreasonable therefore to assume that some of these patients would not develop epilepsy if the skull defect were repaired at the time of the initial debridement.

In penetrating wounds of the brain neurosurgeons are familiar with the encephalographic picture showing the migration of the ventricle toward the bony defect (fig. 1). This migration is caused by (1) destruction of brain tissue by the passage of the missile, (2) scar tissue contraction, and (3) *progressive atrophy due to the pulsation of the mobilized brain* (3). If the bony defect is closed at the time of debridement, the third factor can be eliminated. In view of these considerations, it would appear that morbidity could be reduced if a satisfactory closure of the bony defect were possible at the time of the initial debridement. The introduction of tantalum to surgery (4) (5) (6) (7) provides a means of accomplishing this.

Tantalum is a metal, the seventy-third element in the periodic series. It is marketed in sheets of varying thickness 6 inches square. In human tissues this metal is practically inert. A sheet of tanta-

lum 0.0125 inch (0.3 mm.) thick affords adequate protection over a cranial defect of any size, yet is sufficiently soft and ductile to be cut with tin shears and shaped with a hammer at the operating table. Improvement in healing of contaminated wounds obtained with the use of sulfonamides and penicillin makes it perfectly feasible to use tantalum implants in the immediate closure of contaminated wounds of the skull.

Method of tantalum cranioplasty.—The proposed tantalum implant is cut large enough to overlap the bony defect. Elaborate shaping and fastening are not indicated in fresh traumatic wounds. The implant is bent to conform roughly to the contour of the outer table of the skull and is held in place by closure of the scalp over it. The abnormal mobility of the brain is thereby immediately reduced. The bloody cerebrospinal fluid escapes about the edges of the implant and is absorbed by the scalp tissues; therefore decompression is still provided although bulging of the brain is prevented, progressive traumatizing of the brain by the defect is avoided, and the possibility of a cerebral fungus is obviated. Healing is facilitated by the splinting of the wounded brain and scalp. Undue traction on the stitches is thus avoided. Repair of a defect in the dura is unnecessary as new dura forms beneath the implant.

In my series of 15 tantalum cranioplasties performed during the past 13 years, the defects varied from 1 inch to 5.5 inches in width, the largest implant measuring 6 inches in diameter. Two compound fractures of the skull were treated by immediate tantalum repair. These cases are described as follows:

CASE REPORTS

Case 1.—While endeavoring to remove a heavy tire, a young man, age 24, was struck in the midfrontal region by the rim of a truck wheel. He sustained a compound comminuted fracture of the skull with laceration of the brain and dura. He was not rendered unconscious immediately but lost consciousness later and had five generalized convulsions.

On 11 June 1943, 14 hours after injury he was operated upon under sodium pentothal anesthesia. The margins of the linear scalp wound were trimmed and retracted, and fragments of loose bone were removed, leaving a bony defect measuring 1 by 2.5 inches. Some macerated brain tissue was removed by gentle irrigation and suction, and a bleeding point on the cortex was controlled by electrocoagulation. The lacerated dura and sagittal sinus were not bleeding and were left undisturbed. A piece of tantalum 0.0125 inch (0.3 mm.) thick was fashioned to cover the bony defect and was laid on the outer table of the skull. Powdered sulfanilamide was introduced, and the wound was closed with a single buried tier of interrupted black cotton sutures in the galea. No drainage was used. Oral administration of sulfadiazine was begun the next day.



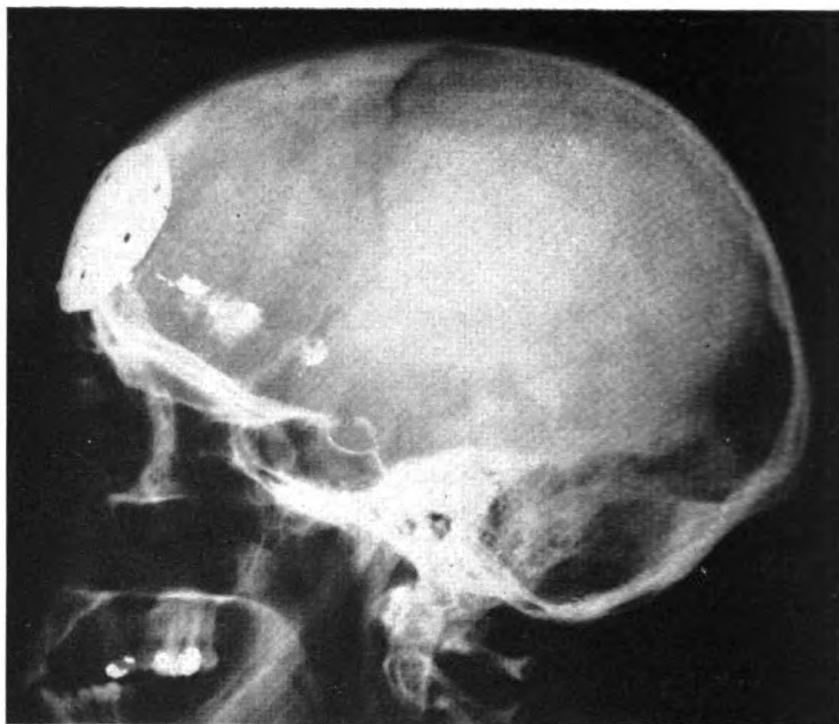
2. Case 1. Roentgenogram showing tantalum implant covering cranial defect.

The wound healed quickly without fluid accumulation, and the patient was discharged free of symptoms on the twelfth postoperative day. He resumed his work as a truck driver within 2 months. He was last seen on 28 March 1944. He had lost no time from his work, and the cosmetic result was good (fig. 2).

Case 2.—A bullet from a .38-caliber revolver struck a woman, age 34, in the right frontal region. She was not unconscious, and there was no paralysis or convulsion. X-ray films showed a defect in the frontal bone above and to the right of the frontal sinuses. Particles of lead and bone outlined the tract leading deep into the right frontal lobe.

Operation was performed on 8 February 1944, 7 hours after the injury. The patient was anesthetized with sodium pentothal. Removal of the emergency dressing disclosed a mass of extruded macerated brain tissue concealing the wound. The scalp was shaved and cleansed, revealing a wound of entrance and a wound of exit separated by a bridge of skin 0.5 inch wide. The bridge of skin was divided, the edges trimmed, and the wound lengthened by an incision at each end.

The wound was irrigated with physiologic saline solution, and a quantity of macerated brain tissue, clot, and bone fragments was removed from the bullet tract by an aspirator. The bony defect was enlarged with a rongeur so that bleeding points in the brain and dura could be adequately controlled by electrocautery. The defect measured 1 by 2 inches. A small quantity of sulfanilamide crystals was dusted on the lacerated brain. A piece of tantalum 0.0125 inch (0.3 mm.) thick was shaped, perforated, and placed over the cranial defect. A single tantalum screw was used to fasten the implant to the outer table of the skull. The scalp was closed by a buried tier of interrupted black silk sutures in the galea and two superficial sutures in the skin.



3. Case 2. Roentgenogram showing track of missile and perforated tantalum implant.



4. Case 2. Note contour of forehead restored.

The patient was given a plasma transfusion during the operation. Oral administration of sulfadiazine was begun the next day.

The wound healed rapidly without evidence of inflammation. Convalescence was uneventful, and the patient left the hospital on the fourteenth postoperative day. The cosmetic result was excellent (figs. 3 and 4). She showed no emotional reaction to the tragedy in which she had lost her family and had almost lost her life. This symptom was attributed to damage to the right frontal lobe. She resumed her job at a war plant 7 weeks after the accident.

COMMENT

Because of its simplicity, immediate tantalum cranioplasty for head wounds is feasible in war surgery. It need not prolong the operation of debridement and closure by more than 5 minutes. No special tools are required in its application because the sheet of tantalum can be cut with heavy bandage scissors and bent to the proper contour in the operator's hands. The surgeon may prefer, however, to borrow tin shears, a roundheaded hammer, a concave block, and a metal punch from the metalsmith.

If the implant is not fastened to the skull, it should be fashioned considerably larger than the cranial defect to allow for some lateral slipping. If the implant is not fixed, the patient may be aware of a clicking sound of metal against bone, which disappears with encapsulation of the implant. I have found that small tantalum screws furnish the quickest and best method for fixation. However, tantalum screws of the proper size are not yet generally available. Because of the possibility of undesirable electrolytic effects, screws of other metals should not be used. For the same reason the operator should try to remove all metallic foreign bodies from the immediate vicinity of the implant. Perforating the implant is an advantage in that it permits needling of the brain should a brain abscess subsequently develop in the track of the missile.

Immediate tantalum cranioplasty in penetrating brain wounds has certain obvious advantages. The procedure (1) immobilizes and protects the traumatized brain and scalp during the healing process; (2) prevents adhesions between brain and scalp, which greatly facilitates a secondary surgical procedure if necessary; (3) reduces the incidence of cerebral fungus and post-traumatic epilepsy; (4) prevents the progressive brain atrophy which undoubtedly occurs beneath a cranial defect; and (5) obviates the need for secondary cranioplasty.

Possible disadvantages of the method are that with the accumulation of a large series of cases, it may be found that the introduction of this practically inert material may cause a higher incidence of infection. If other metals are present in close proximity to the tantalum implant, undesirable electrolytic effects may result. Dur-

ing early convalescence the patient may be aware of a clicking sound of the metal against the bone if the implant is not fixed to the skull; and finally, the presence of the implant may interfere with diagnosis or treatment of a subsequent brain abscess. In my opinion, however, these hypothetical disadvantages are far outweighed by the advantages listed.

REFERENCES

1. FORBES, H. S.: Cerebral circulation; observation and measurement of pial vessels. *Arch. Neurol. & Psychiat.* 19: 751-761, May 1928.
2. GRANT, F. C., and NORCROSS, N. C.: Repair of cranial defects by cranioplasty. *Ann. Surg.* 110: 488-512, October 1939.
3. FALCONER, M. A., and RUSSELL, D. S.: Experimental traumatic cerebral cysts in rabbit. *J. Neurosurg.* 1: 182-189, May 1944.
4. CARNEY, H. M.: Experimental study with tantalum. *Proc. Soc. Exper. Biol. & Med.* 51: 147-148, October 1942.
5. BURKE, G. L.: Corrosion of metals in tissues; and introduction to tantalum. *Canad. M.A.J.* 43: 125-128, August 1940.
6. PUDENZ, R. H.: Repair of cranial defects with tantalum; experimental study. *J.A.M.A.* 121: 478-481, February 13, 1943.
7. FULCHER, O. H.: Tantalum as metallic implant to repair cranial defects; preliminary report. *J.A.M.A.* 121: 931-933, March 20, 1943.

THROMBIN AND FIBRINOGEN IN REMOVAL OF RENAL
AND BILIARY CALCULI

The use of thrombin and fibrinogen for the removal of renal calculi is unique. The kidney is exposed, and the pelvis flushed with saline through a catheter and emptied. Fibrinogen and thrombin are then simultaneously injected. Clotting begins within 30 seconds and is complete within 60 seconds. After 5 minutes a fibrin clot, 5 to 10 times as strong as a human blood clot, enmeshes all calculi. Then the usual pyelotomy incision is made, and the coagulum is grasped with ring forceps and removed with the enclosed calculi. Five cases have been successfully treated. Experimental work tends to show the procedure to be harmless to kidneys. A similar procedure may well become applicable in removing biliary calculi high within the biliary tree.—DEES, J. E.: Use of intrapelvic coagulum in pyelolithotomy. *South. M. J.* 36: 167, March 1943.

TRAUMATIC HEMOTHORAX

JOSEPH D. CUONO

Lieutenant (MC) U.S.N.R.

Hemorrhage into the pleural cavity occurs in nearly all penetrating wounds of the thorax. The extent of the hemorrhage depends upon the vascular source and may involve any of the following vessels: The intercostals, the internal mammary, the large intrathoracic hilar vessels, or the vessels of the lung parenchyma.

Death may result early, within a few hours, from exsanguination. It must be borne in mind that a free pleural space may accommodate more than 5,000 cc. of fluid; consequently there may be very little respiratory distress in the early stages of a slow, continued hemorrhage. Later, however, due to mediastinal displacement and encroachment upon the opposite lung, the severe anoxia is quickly followed by a complete hemorespiratory collapse.

Laceration of the lung also permits the escape of variable amounts of air into the pleural space. The air is usually rapidly absorbed unless a larger branch of a bronchus is torn, creating a bronchopleural fistula. Injuries in which ribs are fractured may be accompanied by a subcutaneous surgical emphysema. In the presence of this type of emphysema, rib fracture with an underlying pneumothorax and possible hemopneumothorax should always be suspected. Hemoptysis is commonly present with lung injury, but in itself is no indication of the presence or extent of intrapleural hemorrhage.

Bleeding from a simple lung injury rarely is profuse and is, as a rule, self-controlling. This is due chiefly to the lower pressure in the pulmonary circuit, which is about one-fourth of the systemic pressure. In addition, the ensuing lung retraction effectively seals the laceration unless it is very extensive or deep. The great danger involved in deep lacerations is the possibility of a bronchopleural fistula acting as a check-valve mechanism. The resulting tension hemopneumothorax becomes a surgical emergency. Another insidious danger is the possibility of intermittent leakage from the bronchial opening which may occur at any moment after the initial control of the emergency.

Although hemorrhage thus tends to be self-controlling, injudicious moving of the patient and vigorous antishock therapy may easily start hemorrhage anew. It is therefore wiser to delay blood

and fluid replacements in this type of injury until one is reasonably certain that the lung wound is sealed. This does not imply that ample antishock measures should not be employed in the presence of definite or impending shock. These patients, and in general, all thoracic casualties, should be moved as little as possible during the first few days following injury. If transportation becomes necessary, a competent aide should accompany the patient to provide emergency relief from further sudden increase of intrapleural pressure.

Blood in the pleural cavity tends to retain its fluid nature unless there is added infection. It also acts as an irritant so that usually a secondary traumatic effusion follows shortly after the initial hemorrhage. Obviously, this again raises the intrapleural pressure, further increasing respiratory distress. The blood and fluid, especially when under tension, produce a temperature rise which characteristically drops with the relief of the tension and removal of the fluid by aspiration. The bloody fluid gravitates to the dependent costophrenic space.

It must be remembered that as much as 400 to 500 cc. of fluid may be contained in this pleural recess and yet be barely discernible on routine x-ray examination. Since it is physically impossible to empty the pleural space completely by simple aspiration, an adhesive pleuritis usually obliterates this dependent pleural recess. Therefore an attempt should be made to keep the pleural space as dry as possible while lung reexpansion progresses. This will tend to minimize the formation of more extensive pleural changes which ultimately limit the ventilating efficiency of the underlying lung.

Hemorrhage caused by lacerations of the large hilar pulmonary vessels is rarely amenable to treatment. Exsanguination occurs so rapidly that there is hardly time for intervention. Between these two extremes is the hemorrhage, the source of which is an extrapleural vessel such as the intercostal or the internal mammary artery. Death may also occur within a relatively short period despite heroic shock measures unless the bleeding source is secured. Consequently, thorough familiarity with the manifestations of a progressive hemorespiratory collapse is essential. Briefly, the typical clinical picture consists of:

1. Increasing pallor, restlessness, and thirst.
2. Increasing rate and decreasing volume of pulse.
3. Falling blood pressure.
4. Increasing respiratory rate.
5. Cyanosis, replacing the initial pallor, caused by progressive encroachment upon the vital capacity brought about by lung compression and mediastinal displacement.

6. Anoxia, with respirations becoming more rapid and shallow, thus eliminating the available and highly diffusible carbon dioxide.

7. Eventual respiratory alkalosis with respirations now slowed but still very shallow, and apparent loss of air-hunger.

8. The insidious change from the cyanotic asphyxia to the grave pallid type, which may easily lull the observer into a false sense of security unless he is familiar with this so-called "Bohr effect."

9. A further increase in the anoxia because of the Bohr effect precipitates a complete peripheral vascular collapse.

The most important and easily measurable signs which should be carefully checked at frequent intervals are (1) the position of the heart apex, and (2) the position of the trachea in the supra-sternal notch. These signs indicate the extent of the mediastinal displacement which can only be brought about by the accumulation of fluid, air, or both in a free pleural space.

SURGICAL MEASURES

The operative measures to be employed in the management of a hemothorax may be stated as follows:

1. *Reduction of the intrapleural pressure.*—This may be accomplished by simple aspiration, usually in the eighth intercostal space in the posterior axillary or scapular line, using local anesthesia combined with adequate preanesthetic narcosis.

Bleeding from simple lung laceration should be managed as conservatively as possible. Adequate sedation with complete mental and physical rest, and lying on the affected side as much as possible tend to normalize the hemorespiratory function very quickly. Aspiration of blood can be delayed at least 48 hours to allow natural sealing-off of bleeding points. Simple aspiration without air replacement should be repeated often enough to keep the pleural space as dry as possible. Excluding complications, lung reexpansion and restoration of a normal cardiorespiratory function should be complete within 3 to 6 weeks.

The pleural cavity must never be completely emptied at a single aspiration unless the technic of air replacement is used. The creation of a high negative pleural pressure may easily initiate further hemorrhage. In addition there is danger of precipitating an acute pulmonary edema caused by rapid lung reexpansion.

2. *Replacement of blood and fluid.*—The milder hemorrhages may not require whole blood replacement. Large blood transfusions should be avoided. It is better therapy to give small amounts at intervals in order to avoid sudden burdening of the right side of the heart in the presence of a temporarily crippled lung.

3. *Ligation of lacerated vessel.*—Ligation should always be done on both sides of the bleeding point before dividing the vessel. This usually requires a rapid wound exposure to gain access to the underlying ribs or costal cartilages. Resection of 1 or 2 inches of rib should afford sufficient exposure for isolation of the vessel.

In an emergency, hemorrhage from an intercostal vessel may be controlled by passing a pericostal suture of nonabsorbable material on both sides of the bleeding area. The location of the wound usually indicates the vessel involved. Rib fracture with or without an external wound points to the intercostals as the source. Parasternal wounds indicate the internal mammary vessels.

It is of utmost importance to keep in mind the high doming of the diaphragm in managing wounds of the lower part of the chest. Penetration of this structure and of the upper abdominal viscera under these circumstances is common and will further contribute to hemorrhage, shock, and infection. A case in point might be briefly mentioned. A Marine was treated for hemothorax and subsequent empyema before admission to a Naval hospital. The penetrating wound involved the left lower anterior portion of the chest. The peculiar color and the odor of the discharge, together with the identical nature of aspirated gastric contents, established the diagnosis of gastrophleural fistula.

In the immediate postoperative period oxygen should be administered if available. Only the combination of oxygen with carbon dioxide will correct a severe respiratory alkalosis.

Precautions in transportation should be observed. The introduction of a tube drain into the pleural space for transportation safety invites a subsequent empyema. Air transport is particularly dangerous in the presence of a hemothorax. The expansion of enclosed air at higher altitudes results in increased hemorespiratory distress.

Retained foreign bodies can be more appropriately attended to at an elective date by thoracic surgeons at better equipped stations. The small group of cases showing recurrent effusions require expert consultation with every effort directed to the prevention of debilitating sequelae.

SUMMARY

The problem of traumatic hemothorax is presented and the source of hemorrhage investigated. Whereas conservative management is recommended in the hemorrhage of lung laceration, the emergency nature of hemorrhage from the systemic vessels is stressed. Medical officers should familiarize themselves with the technic of simple rib resection and vessel ligation in the presence of a continued intrapleural hemorrhage of this origin.

ACHALASIA IN MILITARY SERVICE

TREATMENT AND DISPOSITION

RICHARD R. HOFFMAN

Lieutenant (MC) U.S.N.

Achalasia probably represents the most frequent esophageal abnormality encountered among military personnel. The diagnosis is usually established with little difficulty but the treatment and disposition warrant further discussion.

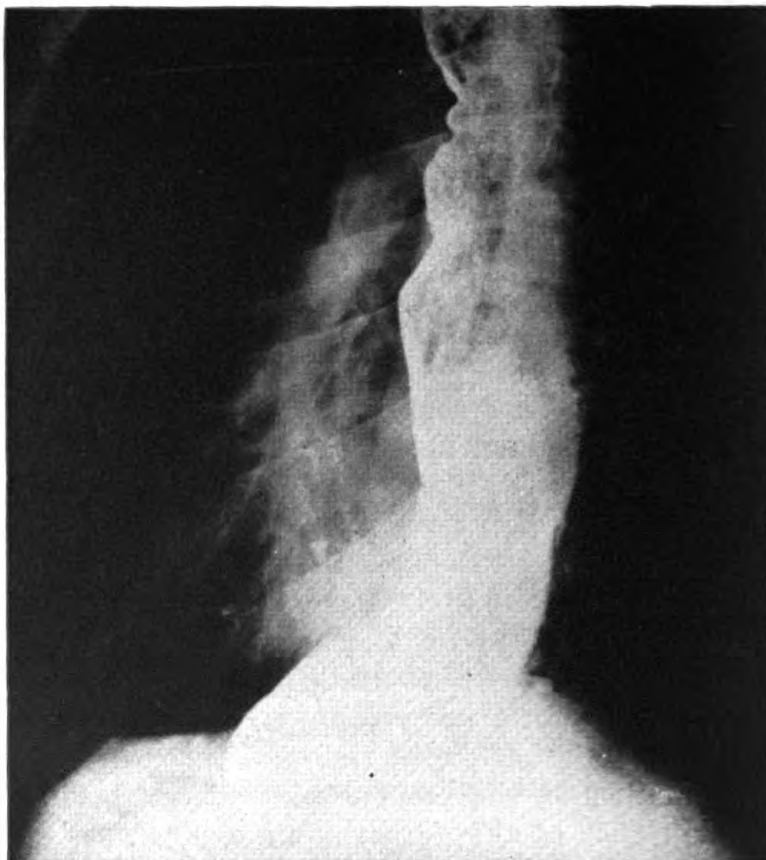
Common synonyms for this condition are cardiospasm, phrenospasm, congenital dilatation of the esophagus, preventriculosis, and idiopathic dilatation of the esophagus.

Anatomists have never definitely demonstrated a sphincter at the cardia, hence the term cardiospasm is a misnomer. The exact cause is not known but that there exists a disturbance in the neuromuscular mechanism in the esophageal walls, associated with a failure of relaxation of the diaphragmatic pinchcock, is widely accepted. In many respects achalasia is comparable to Hirschsprung's disease and megalo-ureter.

The theory that a psychogenic element is an underlying factor seems unlikely, from the personality studies that have been made on a large series of cases. The condition is known to occur as frequently among phlegmatic as among emotionally unstable individuals.

That achalasia, or the predisposition to it, is congenital is rather generally accepted. Therefore every case of achalasia must be considered as having existed prior to enlistment, which is the important point when treatment and disposition are being considered.

The characteristic symptoms of the condition are some degree of dysphagia, regurgitation, or pain. Any of these complaints may be poorly defined or very marked. In nine cases, observed among Naval personnel, there was an element of dysphagia and slight mediastinal discomfort in the majority; in one case the individual suffered from paroxysmal attacks of sharp excruciating pain. The symptoms of regurgitation were roughly commensurate with the degree of superimposed esophagitis later noted on fluoroscopic examination. A significant diagnostic symptom usually elicited is the feeling of the esophageal contents suddenly rushing into the stomach, with immediate relief of the mediastinal discomfort.



An anterior oblique view shows the dilated, barium-filled esophagus with the smooth, fairly symmetrical, constriction at the cardia, typical of achalasia.

Achalasia is usually easily recognized fluoroscopically and roentgenographically in the routine swallowing function. The esophagus appears dilated, with a smooth, fairly symmetrical constriction at the cardiac end. There is invariably evidence of a residue of fluid and food particles in the lower third. Reverse peristaltic waves, incident to the superimposed esophagitis, are frequently observed.

The essential conditions to be differentiated from achalasia are benign organic stricture in the lower esophagus, and carcinoma. The density caused by food particles, located at the cardiac end of the esophagus, may occasionally be mistaken for a filling defect and thought to be due to a carcinoma. In such cases the esophagus should be lavaged and the examination repeated. A significant differential sign, fluoroscopically, is the sudden rush of the barium from the esophagus into the stomach, which rules out obstruction from an organic stricture. Esophagoscopy is a valuable aid in the diagnosis and should be used whenever it is available.

There are very few serious complications associated with this abnormality. Occasionally pulmonary infections may occur from

regurgitation and aspiration of material into the bronchi. Inanition and even death by starvation occur; however most of these individuals remain surprisingly well nourished.

The following case report is typical.

A 26-year-old ship's cook, third class, first experienced symptoms of achalasia when he was 23 years old. The chief complaint was that it required more time for him to eat than others. While sitting at the table, he experienced a fullness in the throat which prevented him from eating, even though he still felt very hungry. Suddenly, he stated, the food gushed into his stomach and then he could resume eating. Fluoroscopically it was noted that, when the level of the liquid barium approached the region of the supra-sternal notch, the material suddenly rushed into the stomach, leaving a residue in the lower one-third of the esophagus.

It is generally agreed that the best form of treatment of achalasia is judicious dilatation of the cardiac end of the esophagus. A detailed discussion of the procedure is beyond the scope of this article. A dilating bougie or the Russell hydrostatic dilator, and occasionally retrograde dilatation of the cardiac end of the esophagus are employed as indicated. Vinson¹ states that 75 percent of all cases can be cured by proper dilatation. Surgical procedures such as cervicothoracic sympathectomies, phrenic crush or exeresis, and plastic operations should be discouraged in these cases, since the results are not only disappointing but in addition such procedures definitely establish a service connection.

SUMMARY

Achalasia, the most common esophageal abnormality encountered among military personnel, is considered to be a congenital anomaly; therefore all cases must have existed prior to enlistment.

To avoid definite service connection of this condition, it would seem prudent to survey these patients from military service before instituting treatment.

The treatment of choice is proper dilatation of the cardia. Neurosurgery and plastic operations are not only of little value but frequently result in serious complications.

¹ VINSON, P. P.: Treatment of cardiospasm. South. M. J. 23: 243-247, March 1930

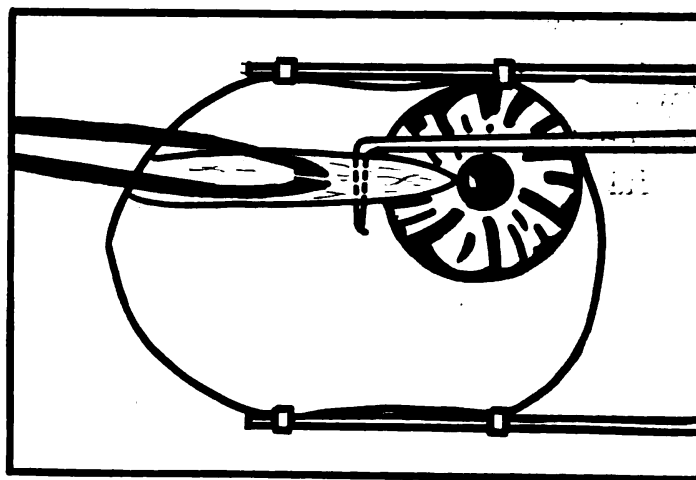
PTERYGIUM TRANSPLANTATION BY SIMPLIFIED METHOD

LYCURGUS M. GURLEY, JR.
Lieutenant (MC) U.S.N.R.

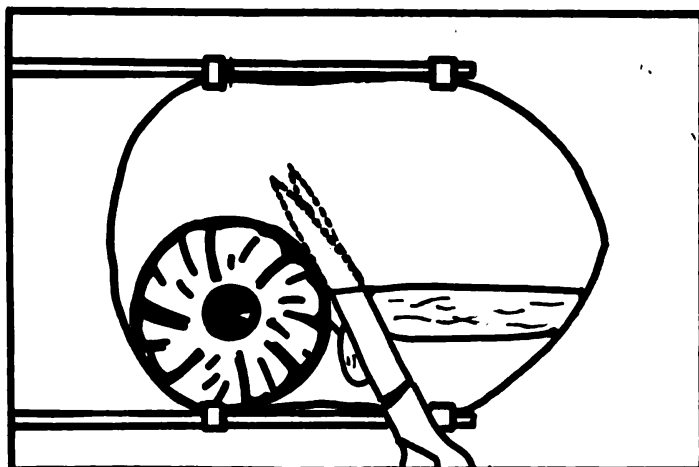
With the increased number of Naval personnel being exposed to factors which predispose to the growth of the true type of pterygium, it is reasonable to expect that the medical officer will be confronted by occasions when a transplantation is indicated. Since it is imperative that the pterygium be removed from the cornea before it encroaches upon the pupillary area with resulting impairment of visual acuity, a simplified technic of transplantation is submitted as a substitute for the more difficult and longer dissection methods.

The affected eye is prepared for operation by the usual methods of irrigation (solutions of metaphen 1:5,000, bichloride of mercury 1:5,000, or boric acid), and anesthesia is obtained by local instillation of the anesthetic agent preferred. Two-percent pontocaine hydrochloride, 4-percent cocaine, 2-percent butyn, or 1-percent holocaine to which a drop of epinephrine hydrochloride in 1:1,000 solution is added will prevent excessive bleeding, although hemorrhage is not usual with this procedure as sharp dissection is avoided.

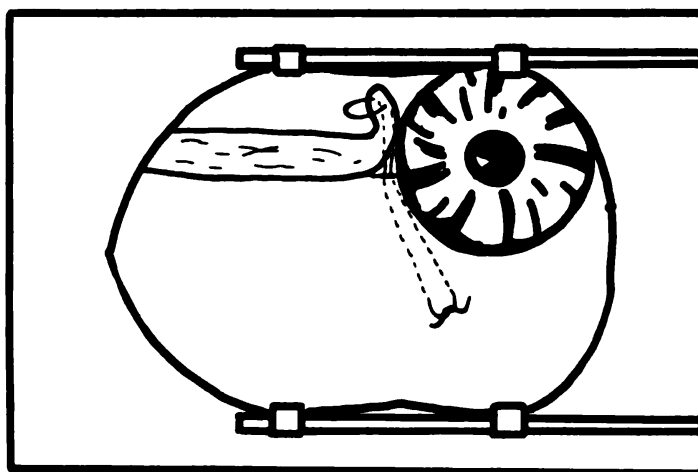
Following insertion of the speculum, as shown in figure 1, the body of the pterygium is firmly grasped with fixation forceps, and



1. Muscle hook undermining neck of pterygium.



2. Opening the subconjunctival pocket.



3. Double-armed suture through pterygial head and exiting from subconjunctival pocket.

a small muscle hook is passed from above downward below the pterygium and slightly lateral to the limbus. Light pressure is necessary to penetrate the conjunctiva at the points of entrance and exit. Then, with a combined teasing and rocking motion, the muscle hook is slowly carried to the head of the pterygium until the growth is cleanly torn away from its corneal attachments.

As shown in figure 2, closed dissecting or tenotomy scissors are then inserted beneath the inferior lip of the resulting conjunctival opening and gently passed subconjunctivally to the inferior midline area, then opened and withdrawn in the usual blunt dissection manner. As shown in figure 3, a double-armed suture of braided or twisted silk is passed, one arm through the superior edge of the pterygium, through the previously made subconjunctival space, to

COLD HEMAGGLUTINATION TEST IN DIAGNOSIS OF PRIMARY ATYPICAL PNEUMONIA

ARTHUR A. HUMPHREY
Commander (MC) U.S.N.R.

The phenomenon by which the cells of an individual are agglutinated by his own serum is one which has been occasionally observed for many years. Until the past year, however, it was accounted merely a curiosity, and a rare but somewhat awkward obstacle in blood matching. It was also noted that clumping of the cells was decidedly more marked when the blood was chilled, and that this seldom occurred at body temperature. In 1943 (1) a relationship was noted for the first time between this agglutination reaction and cases of primary atypical pneumonia.

The literature on primary atypical pneumonia, to which is usually added "of unknown etiology," is almost entirely contemporary, so that one wonders if the entity actually existed in its current form prior to 1941, despite various reports of similar, or symptomatically allied outbreaks, as early as 1872 (2). It is now unquestionably more prevalent in military concentrations, institutions, and schools. This observation, however, may be more apparent than real, as in these places the mild cases are more readily brought to a physician's attention.

The discovery of the cold agglutination reaction, one conjectures, would have been made long ago if the disease entity, or syndrome, had long been with us. In fact the reaction was observed as early as 1910 in trypanosomiasis (3), a disease which must not be considered too common even in areas where it is endemic.

Considerable experimentation preceded the selection of a method to be used in the present study. At first autoagglutination was tried, no particular attempt being made to wash the cells free of serum, and this gave erroneous readings in the higher dilutions. Next, a correlative series was made, employing the isohemagglutination technic as advocated by Horstmann and Tatlock (4). The latter method, utilizing the washed erythrocytes of Group O, was found to be far less sensitive than the autohemagglutination method, and showed negative results in many cases which were typical of primary atypical pneumonia both clinically and roentgenographically. It was abandoned for this reason, and also because the character and sensitivity of the washed suspension of Group O

cells appeared to change during storage. This made the graphic representation of changes in titer during the course of the disease somewhat vague and haphazard.

The necessity of using fresh serum has been stressed by several workers who observed that negative reactions occurred in blood stored for a month or more. In the present study it was noted that the titer of the serum was only a fraction of its original strength, even after as short a period as 5 days of refrigerator storage.

The method to be described was developed as a standardized procedure. Like Turner (5), an early investigator, I was astonished by the definite agglutination shown in the positive cases as contrasted to the controls. In collecting control serum from the ward patients the blood was taken simultaneously with that removed for the routine Kahn test. Despite opinion to the contrary (6), low-titer dilutions, such as 1:4, have been considered significant when marked agglutination is present. In a number of cases subsequent tests revealed positive reactions in a rising titer, which appears to prove the wisdom of this contention.

Method.—For the specific purpose of performing a cold agglutination test, or in conjunction with the withdrawal of blood for a Kahn test or for purposes of culture, the blood is subjected to the following procedure:

1. Six drops of blood are placed in a centrifuge tube containing 10 cc. of 2.5-percent sodium citrate solution, and the solution is mixed by inverting the tube. To insure uniformity a 21-gage needle is used, with the bevel held downward while the 6 drops from the syringe are delivered.
2. Four to six cc. of the citrated blood is placed in a small test tube and permitted to clot. If the serum does not separate readily from the clot, it is centrifuged.
3. The cells are centrifuged for 15 minutes at 2,000 revolutions per minute, the supernatant citrate is poured off and the packed cells are resuspended in 2 cc. of 0.85-percent saline solution.
4. Next, 0.75 cc. of normal saline solution is placed in a small test tube and 0.25 cc. of the serum is added to make a 1:4 dilution, and to this is added 0.1 cc. of the cell suspension.
5. This small test tube is then placed in a rack which is immersed in water and ice, and the rack and its container are then placed in an ice chest or refrigerator. Under ordinary circumstances the temperature will remain between 1° to 4° C. for hours, but it should be checked by a thermometer immersed in the ice and water mixture.
6. After allowing the tube to remain in the refrigerator overnight, the reading is made. If agglutination is present it will disappear in a few minutes, or at the most within an hour, at room temperature. When the mixture is replaced in the ice bath, it will reagglutinate within a few hours. This reversibility is characteristic and should be employed in doubtful cases.

To determine titer.—Further dilutions are made by setting up a series of 10 test tubes, placing 1.5 cc. of normal saline solution in

the first tube, and 1 cc. each in the remaining nine. After pipetting 0.5 cc. of the serum into the first tube of the series, 1 cc. is transferred, after mixing, to the second, and so on down the line of tubes, discarding the last cubic centimeter from the tenth tube. To each tube, 0.1 cc. of the patient's own cell suspension is then added and the tube is placed in the ice bath overnight.

Reading the agglutination reaction.—As a rule the result is definitely positive or negative, but a standard method of agitation should be employed. The tube should be inverted slowly four times, or flicked with the finger a definite number of times before reading. Placing the racks in the Kahn shaker, set at the usual speed, required approximately 15 seconds, but this refinement was not considered necessary after some practice had been gained in reading.

If the reaction is 3-plus or 4-plus, the heavy clumps float in a clear fluid and quickly settle to the bottom; if the red cells form a solid clump or disc, it is definitely a 4-plus reaction. If the clumps are fine and granular on agitation, but the background is still a clear solution, it should be considered a 2-plus reaction; if the background is faintly pink or pearly it is a 1-plus reaction. Negative reactions show the pink iridescence indicative of individual cell dispersion. If this pearly or nacreous sheen is present in any degree, even in the presence of clumps, it should be considered a negative reaction.

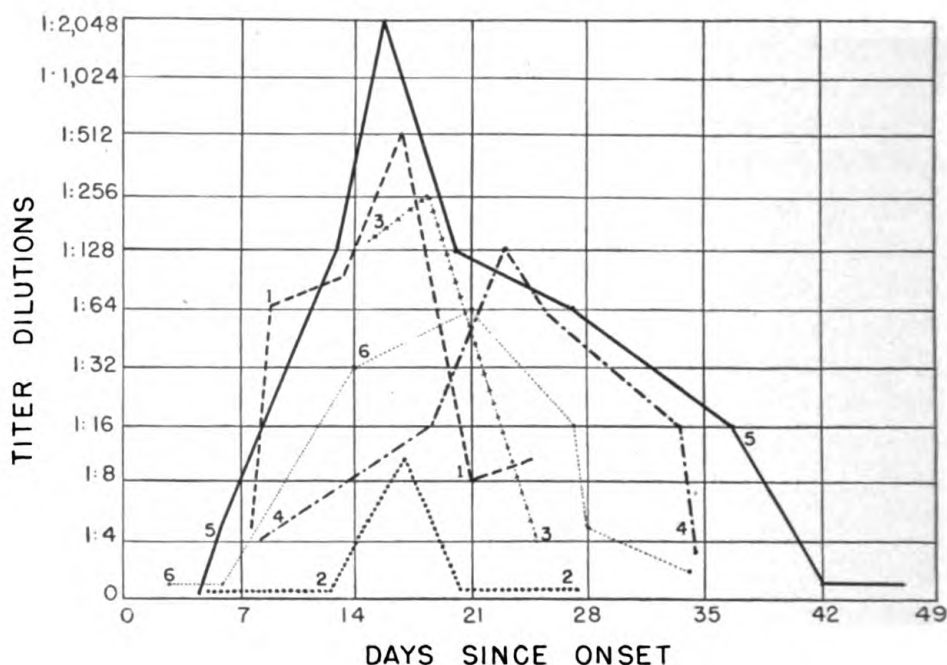
Over 200 cold agglutination tests were made on approximately 100 patients. The following cases were selected for reporting briefly either because their titer curves are shown on the accompanying graph (first 6 cases) or because they illustrated some particular point. All the patients were young, male, previously healthy Marines.

CASE REPORTS

Case 1.—This patient was admitted to the hospital complaining of a sore throat and headache of 48-hour duration, and fever, cough, and chills for 24 hours. Physical examination revealed no findings of note. The leukocyte count was 9,700.

A provisional diagnosis of acute catarrhal fever was made. The fever ranged between 101° and 103° F. for a week before returning to normal. A chest x-ray made 2 days after admission demonstrated an irregular, diffuse infiltration in the middle lobe of the right lung consistent with pneumonitis, and the diagnosis was changed to primary atypical pneumonia. However because of the admission diagnosis, blood was taken on the sixth hospital day to serve as a control in the series of cold agglutination tests.

The reaction was 4-plus in a 1:4 dilution and a check revealed that the diagnosis had been changed to primary atypical pneumonia without the laboratory's being aware of it. It seems quite probable that a positive reaction would have been obtained several days earlier had a specimen been ob-

Agglutination reactions in 6 cases

tained, since a sharp rise in titer to 1:128 was noted on the following day. The remaining readings can be observed by consulting the graph. Three weeks after admission the patient was returned to duty. Two days before discharge the titer had dropped to a dilution of 1:8. It was checked again 6 days later and was found to be essentially the same.

Case 2.—This patient was admitted with the diagnosis of acute catarrhal fever. The fever was 103° F. and the patient had chills. Symptoms of a head cold had been present for 2 days. The leukocyte count was 2,900, and the sedimentation rate by the Cutler method, 25 mm. in 1 hour. An x-ray of the chest at this time showed evidence of a right lower and a right central lobe pneumonitis.

The first positive agglutinin reaction, noted 14 days after onset of the disease, was strongly so; it had been negative 2 days earlier. As shown on the graph, a high level titer was never attained and the positive reaction was very transient. The patient had a serious febrile relapse 1 week after admission which lasted 7 days, and it is believed that this might have clouded the relationship between the test and the clinical progress.

Case 3.—The patient was admitted to the hospital with a fever of 103° F., associated with upper respiratory symptoms which had been present for 4 days. He became afebrile on the second hospital day and remained so. Râles were heard in the base of the left lung, and x-ray examination on the third hospital day revealed an infiltration of the lower lobe of the left lung consistent with pneumonitis.

The leukocytes numbered 14,200 per cu. mm. The râles continued to be present until the twentieth day, when they disappeared. A chest x-ray made on the fourteenth day showed some residual infection but clearing was in progress. On the sixteenth day of illness there was a strongly positive cold

agglutination reaction in a dilution of 1:128; three days later it rose to 1:256, with a weak reaction in 1:1,024. It then dropped abruptly as shown on the graph.

Case 4.—The patient entered the hospital with the diagnosis of gastro-enteritis. For 1 week he had suffered from chills, cough, headaches, and extreme nausea. His fever on entry was 102° F. which returned to normal in 5 days. The white blood cell count was 7,850 and the sedimentation rate 15 mm. in 1 hour. An x-ray taken on the day following admission revealed a dense infiltration in the upper lobe of the right lung and base of the left lung characteristic of primary atypical pneumonia.

Blood for a cold agglutination test was taken 48 hours after entry. The test was 4-plus in the 1:4 dilution and slowly increased in titer, as shown on the graph, returning to a nearly normal level in 25 days.

Case 5.—This patient was admitted to the hospital with the diagnosis of bronchopneumonia. The onset had been 24 hours before entry and was characterized by chills and fever. The leukocyte count was 12,000 and the sedimentation rate 28 mm. in 1 hour (normal 10 mm.). The diagnosis was changed to atypical pneumonia 48 hours after entry when a chest x-ray examination revealed considerable infiltration characteristic of pneumonitis in the lower lobe of the left lung.

A cold agglutination test 6 days after the onset, showed a 4-plus reaction in a 1:4 dilution and a weak reaction in 1:64. The titer reached the high level of 4-plus in a dilution of 1:2,048 in 10 days and had not returned to a negative status after 43 days. Twenty-one days after the onset there was x-ray evidence of residual density in the lung fields.

Case 6.—The patient entered the hospital with the diagnosis of acute catarrhal fever, having its onset 2 or 3 days prior to admission. The cold agglutination test made 4 or 5 days after the onset, was negative, and was again negative when repeated on the following day. A chest x-ray taken 10 days after admission showed evidence of a pneumonitis, and a cold agglutination test performed the following day showed a 4-plus reaction in a dilution of 1:16. Maximum titer was reached a week later in a dilution of 1:64 and it declined to a nearly normal level on the thirty-third day of the illness.

Case 7.—This patient was admitted to the hospital on 7 February with the diagnosis of acute catarrhal fever. The leukocyte count was 8,200, and a chest x-ray taken on 11 February revealed no abnormality. The fever did not return to normal until 21 February, at which time x-ray examination revealed a pneumonitis of the upper lobe of the right lung; the leukocyte count had increased to 12,100 and the sedimentation rate was 27 mm. in 1 hour. The patient improved but there was still x-ray evidence of a residual infection on 8 April although the sedimentation rate had returned to normal.

On 6 April the cold agglutination test was strongly positive in a 1:8 dilution, and on 19 April it was 3-plus in a dilution of 1:4. It should be noted that these positive agglutinations were observed 56 and 75 days, respectively, after the onset.

Case 8.—This patient was admitted to the hospital on 11 May, and a diagnosis of primary atypical pneumonia was made on x-ray evidence of a diffuse infiltration of the upper lobe of the right lung consistent with pneumonitis. The fever ranged from 101° to 104° F., and the leukocyte count was 24,600.

The patient had been ill for 3 days prior to admission, but repeated cold agglutination tests were negative. On 15 May a blood culture taken 3 days previously was found positive for the pneumococcus, and a check x-ray taken on 16 May showed a definite consolidation of the upper lobe of the right lung which was typical of lobar pneumonia. Although in this instance the blood culture led to the change in diagnosis, the negative agglutination tests might also have done so.

CONTROL GROUP

Cold agglutination tests were performed on 80 patients at least once, and in many instances were repeated. An effort was made to select patients who suffered from some pulmonary or upper respiratory infection; consequently the majority of the cases included acute catarrhal fever, bronchopneumonia, lobar pneumonia, bronchitis, pharyngitis, bronchiectasis, tonsillitis, and active and quiescent tuberculosis. A number of diseases having a virus as a causative agent, as mumps and measles, were also included.

In these 80 controls no strong reaction was observed in the least dilution, which was 1:4. One patient with acute tonsillitis showed a positive 1-plus reaction on two occasions, as did two convalescent meningococcus meningitis patients, and one who had active tuberculosis. A 2-plus reaction was observed on the sixth day of illness in a patient believed to have pneumonitis; however negative reactions were obtained on the tenth and fourteenth days of the illness, when a well marked lung abscess was visualized by x-ray. This is not usually regarded as a complication of primary atypical pneumonia. It is possible that the five reactions noted in this group should be disregarded because of their weak character and that the controls should be considered to be 100 percent negative. Cases 1 and 4 are not included among the 80 controls which had originally been included on the basis of their admission diagnoses.

COMMENT

In addition to the 80 controls, a careful study was made during the same period of 19 patients whose illness had been diagnosed as primary atypical pneumonia by clinical findings, x-ray evidence, or both. Nine of these patients yielded 4-plus reactions, 4 weaker reactions, and 6, even on repeated trials, were negative. In analyzing the cases which were negative, a cause can be found for such a reaction in all but one instance. In 3 of the 6 cases the blood for the agglutination tests had been withdrawn between 39 and 46 days after the onset of the illness, whereas further experience has shown that the titer returns to a low level after 30 days, and is often completely negative by the fortieth or forty-fifth day, despite

an occasional exception such as case 7. It is considered very probable in this case that positive reactions might have been obtained earlier in the illness had a blood specimen been taken. In two other cases weak reactions were observed 40 and 47 days after the onset. Of the remaining three negative cases, it was found that the diagnosis of primary atypical pneumonia was incorrectly made in two and was subsequently changed. Case 8, for example, on further study proved to be lobar pneumonia, and in the other, recovery was so rapid that the diagnosis was changed to acute catarrhal fever.

In the last instance, the sedimentation rate was only 5 mm. in 1 hour which is inconsistent with the markedly accelerated rate observed in primary atypical pneumonia, and the x-ray findings in this case were at best only suggestive. The actual cases are thus reduced to 17, and of these, 3 were considered to be well beyond the active phase of the disease.

Of the 14 cases studied by agglutination tests in what was apparently the active phase, or early convalescence, all but one were positive (93 percent). The failure of the one case to give a positive cold reaction could not be explained, as the x-ray findings, the clinical course, and the physical findings were typical of primary atypical pneumonia. With the exception of this case, all the reactions noted before the nineteenth day of illness were strongly positive.

The results of this study are quite similar to those noted by Turner and Jackson (7) who found positive cold agglutination reactions in 90 percent of their cases of primary atypical pneumonia in the British Isles.

In the experience of some observers (8) the negative character of the controls has not been a constant finding, as positive reactions have been found in anemias, hemolytic icterus, liver disease, and in some apparently healthy persons. One also might speculate on the possibility in some of these instances of a recent, or subclinical, concomitant attack of primary atypical pneumonia, which was unrecognized, or obscured by the severity of the other disorder. It also should be borne in mind that variations in technic and in reading the test may be in a measure responsible.

The test apparently becomes positive in a low, but diagnostic, dilution between the fourth and eighth days of the illness, although in two cases it did not become positive until the tenth and seventeenth days, respectively, and in both of these only a low titer maximum level was reached, the reaction again becoming negative in a few days. Case 2 is illustrative. Horstmann and Tatlock failed to note any positive reaction before the eighth day, and the majority

of their cases did not become positive until the second to fourth weeks of the illness. It is believed possible that the rather late appearance of the phenomenon in their cases might be largely due to the relatively insensitive method employed.

From a study of the superimposed titer graphs, and from additional cases, it appears that the maximum titer is reached between the sixteenth and the twenty-third days of the illness. Following this a decline takes place which may be precipitous or gradual, but usually fades, or becomes weak, between the thirty-fifth and forty-fifth days, although exceptions are noted. Dameshek (9) noted that one of his cases with a high titer became negative in 6 weeks. Turner and Jackson (7) noted the rise in titer during the second week after the onset of respiratory symptoms, which is essentially what was found in this series.

Although it has been stated that the maximum titer occurred near the end of the febrile period (1), in the present series it usually appeared after the fever had subsided, and a relationship between the titer and the fever was not constantly observed. Severe cases often had a high maximum titer, but this was far from constant and has been noted by others; mild cases rarely developed a strong titer in high dilutions.

An attempt to correlate the titer with the leukocyte count was without result, although some relationship did exist in certain cases with the sedimentation rate. The sedimentation rate has been stated to be of the greatest value (10) in this disease, and is almost invariably markedly accelerated. This finding is consistent with the results observed in this small series.

It is difficult to draw conclusions as to the relationship between the x-ray findings and the titer of the agglutination test. It was apparent, however, that when the titer dropped rapidly, clearing of the lung fields had been in progress only a week or two following the onset, and that when the titer was low at the maximum level, the roentgenographic changes were moderate or equivocal.

It was also noted that in two patients who were clinically well, x-ray evidence of a residual infection was present in one case 35 days following the onset, and in another, 50 days. The agglutination test was rather strongly positive in both instances, but in another two cases the tests became negative despite an obvious residual infection. Van Ravenswaay and his coworkers (10) in a large series of cases found that, by x-ray evidence, lung clearance time averaged 32 days. This figure is almost the exact average length of time in which the test ceased to be positive in the higher dilutions found in the present series.

It must be emphasized that the x-ray diagnosis of this condition is of great help but not exact, and that one x-ray is not sufficient in all instances. Although the sedimentation rate is of value, it is also accelerated in various pneumonias of unknown etiology. The third usual laboratory procedure is the leukocyte count. In atypical pneumonia it usually ranges from a leukopenia to a very moderate leukocytosis of from 12,000 to 16,000 per cu. mm. which renders it of little value in differential diagnosis. White cell counts of 20,000 or more, however, almost invariably indicate some other disease.

It is apparent from the foregoing that the cold agglutination test may offer the most definite criterion for diagnosis of primary atypical pneumonia, particularly when it is observed in high titer, and bolstered by clinical and x-ray evidence. Its limitations and the time of the appearance of agglutinins, however, must be appreciated. If the test is negative early in the disease, it should be repeated, even through the third week of the illness if confirmatory evidence is desired.

In chest illnesses that pursue a long course, as many cases of atypical pneumonia often do, the possibility of a tuberculous infection may cause concern. Fortunately, it has been noted (6) in a rather extensive study of tuberculous cases, that none was positive to the cold agglutination test in high titer.

Among further advantages to be gained from the use of this test is the satisfaction of a fairly definite diagnosis in a rather vague condition. The disadvantage of the late appearance of a positive test is apparent. It must be remembered, however, that the agglutination tests for typhoid, brucellosis, tularemia, infectious mononucleosis, and many other diseases also have this disadvantage.

The test is simple and economical, so simple in fact that it can be performed by anyone who has a centrifuge, pipettes, and an ordinary electric refrigerator. In many instances, if found in high titer, it can eliminate the need for the more costly chest x-ray

Acrocyanosis on chilling has been noted in a patient who had apparently recovered from the acute phase of an attack of primary atypical pneumonia. The investigators (11) felt that this might readily be due to a reversible, intracapillary autoagglutination, as autoagglutination was present at room temperature in high titer. One might speculate that the atelectasis which was observed in the x-ray films in this disease, and which is regarded as a common sequela, may not be due to pulmonic capillary agglutination, resulting in some mild type of infarction which may be the basis of the pulmonic changes. The lack of necropsy material on uncomplicated cases prevents proof of this thesis.

SUMMARY AND CONCLUSION

Nineteen patients with the diagnosis of primary atypical pneumonia were studied clinically to determine their reaction to the cold autohemagglutination test. Two patients were eliminated from this group because of a subsequent change in diagnosis, and three others because it was apparent that they were not in the active phase of the disease when the test was performed. Of the remaining 14 all but 1, or 93 percent, had positive reactions.

No strong reaction was noted in a series of 80 controls who were largely patients with upper respiratory and pulmonic diseases. Only five weak reactions were noted, and it was considered doubtful if they should all be accepted as positives. Two cases in the original group of controls were strongly positive, but on investigation it was found that the diagnoses had been changed to atypical pneumonia without the laboratory's having been informed.

The first positive reactions were noted within 4 to 8 days of the onset, but in instances the reaction might be delayed until the early part of the third week. The maximum titer usually occurred between the sixteenth and twenty-third days of illness, and with but rare exceptions, became weak or negative between the thirty-fifth and forty-fifth days.

Clinically there was little relationship between the titer and the fever, although some parallelism existed between the test and the sedimentation rate, and the x-ray findings.

While the x-ray examination is often confirmatory, other laboratory aids, such as the sedimentation rate and leukocyte count, have proved to be of little value in the diagnosis. It seems very probable that the only procedure with any degree of specificity for the disease may be the cold autohemagglutination test.

The advantages of the test lie in the fact that a definite diagnosis can often be made by its use. It is assumed that sulfonamide therapy is futile in the disease, and a positive test can point to its discontinuance in a condition where it may be prejudicial. In certain instances the test may prove to be a means whereby a simple and economic procedure may supplant the more costly chest x-ray films. A disadvantage lies in the fact that the test is not consistently positive in the first week of the illness, but it should be borne in mind that most of the agglutination reactions for other diseases are positive no earlier.

REFERENCES

1. PETERSON, O. L.; HAM, T. H.; and FINLAND, M.: Cold agglutinins (auto-hemagglutinins) in primary atypical pneumonias. *Science* 97: 167, February 12, 1943.

2. DINGLE, J. H., and FINLAND, M.: Medical progress; virus pneumonias; primary atypical pneumonias of unknown etiology. *New England J. Med.* 227: 378-385, September 3, 1942.
3. YORK, W.: Autoagglutination of red cells in trypanosomiasis. *Ann. Trop. Med. & Parasitol.* 4: 529-552, 1910.
4. HORSTMANN, D. M., and TATLOCK, H.: Cold agglutinins; diagnostic aid in certain types of primary atypical pneumonia. *J.A.M.A.* 122: 369-370, June 5, 1943.
5. TURNER, J. C.: Development of cold agglutinins in atypical pneumonia. *Nature, London* 151: 419-420, April 10, 1943.
6. SIFFERT, R. S., and KRAUTMAN, B.: Cold hemagglutination reactions in tuberculosis. *J. Lab. & Clin. Med.* 29: 270-272, March 1944.
7. TURNER, J. C., and JACKSON, E. B.: Serological specificity of auto-antibody in atypical pneumonia. *Brit. J. Exper. Path.* 24: 121-126, June 1943.
8. MCCOMBS, R. P., and MCELROY, J. S.: Reversible autohemagglutination with peripheral vascular symptoms. *Arch. Int. Med.* 59: 107-117, January 1937.
9. DAMESHEK, W.: Cold hemagglutinins in acute hemolytic reactions in association with sulfonamide medication and infection. *J.A.M.A.* 123: 77-80, September 11, 1943.
10. VAN RAVENSWAAY, A. C.; ERICKSON, G. C.; REH, E. P.; SIEKIERSKI, J. M.; POTTASH, R. R.; and GUMBINER, B.: Clinical aspects of primary atypical pneumonia; study based on 1,862 cases seen at station hospital, Jefferson Barracks, Missouri, from June 1, 1942 to Aug. 10, 1943. *J.A.M.A.* 124: 1-6, January 1, 1944.
11. HELWIG, F. C., and FREIS, E. D.: Cold autohemagglutinins following atypical pneumonia producing clinical picture of acrocyanosis. *J.A.M.A.* 123: 626-628, November 6, 1943.



LEUKOCYTOSIS AS INDEX OF PYROGENICITY

By the intravenous injection of small volumes of water or saline (1 to 20 cc.) into dogs it is possible to detect the presence of pyrogenic substances at or below the level of concentration which will produce symptoms in man. Leukocytosis was the most sensitive, measurable in three to six hours after intravenous administration and lasting for many hours. Progressively less sensitive were the neutrophilia, leukopenia and hyperpyrexia.

The least amount of solution producing a positive response contained 0.056 μ g. of nitrogen. The level of leukocytosis was approximately proportional to the amount of pyrogen in the more dilute preparations.

White blood cell counts alone, however, will suffice to indicate the presence of pyrogens in objectionable concentrations taking an increase of 50 percent above the original count as significant on the basis of counts made 3 to 6 hours after injection.—YOUNG, E. G., and RICE, F. A. H.: Leucocytosis as index of pyrogenicity in fluids for intravenous use. *J. Lab. & Clin. Med.* 29: 735-741, July 1944.

THE COLD AGGLUTINATION TEST

- I. STUDIES ON NAVAL HOSPITAL PATIENTS**
- II. STUDIES ON NATIVES IN YAWS-ENDEMIC AREA**

GEORGE H. FETTERMAN
Lieutenant Commander (MC) U.S.N.R.

THOMAS J. MORAN
Lieutenant (MC) U.S.N.R.

and

WILLIAM R. HESS
Chief Pharmacist's Mate U.S.N.R.

Interest in cold agglutinins has been stimulated recently by the work of Peterson, Ham, and Finland (1), who found them present in abnormally high titer in the sera of a high percentage of patients having diagnoses of primary atypical pneumonia of unknown etiology. Comparable findings have since been reported by others (2) (3).

In this Naval hospital laboratory, at a South Pacific island base, we tested the sera of a large group of service personnel, Naval and Marine, including not only men with respiratory diseases, but also patients exhibiting other contagious or infectious diseases, such as malaria, dengue, and mumps. Included in the study of respiratory disorders are the patients with primary atypical pneumonia of unknown etiology reported by Heintzelman and Seligmann (4).

In addition, advantage was taken of a unique opportunity to apply the test to a number of South Pacific natives. As will be seen, the findings in this group appear to justify separate consideration.

Cold hemagglutinins in high titer have been encountered with regularity only in primary atypical pneumonia of unknown etiology (1) (2) (3), African trypanosomiasis (5), paroxysmal hemoglobinuria (6), and mumps with orchitis (3). From the recent general review of the subject by Stats and Wasserman (6), it is apparent that normal or increased cold agglutinin titers have also been observed, although only occasionally and irregularly, in a bewildering variety of conditions and symptom complexes. These include blood dyscrasias, hemolytic icterus, hemolytic anemia secondary to sulfonamide therapy, primary and secondary anemias, leukemia, thrombopenic purpura, various respiratory conditions including lobar and bronchopneumonia, an assortment of hepatic

diseases, malaria, syphilis, sepsis, Raynaud's disease, acrocyanosis, and urticaria. In this group, hemolytic anemia and hemolytic icterus are most frequently mentioned.

Not included in the above review is Dameshek's recent report (7) of three cases of acute hemolytic anemia associated with sulfonamide therapy. Cold agglutinins were present in high titer in each of these cases.

Helwig and Freis (8) have since reported a case of primary atypical pneumonia in which the presence of cold agglutinins produced the clinical picture of acrocyanosis.

TECHNIC OF THE COLD AGGLUTINATION TEST

The technic followed was essentially the one described by Horstmann and Tatlock (2). Whole blood samples were permitted to clot and separate at room temperature. The sera were then set up in Kahn tubes in dilutions of from 1:4 to 1:4,096 in 1-cc. volumes. To each tube, 0.1 cc. of a 2-percent suspension of triple-washed human red cells, Group O, was added. These cells were obtained fresh daily from one of six donors, the blood of each of whom had been carefully typed with grouping sera of high titer. The tubes were placed in a refrigerator with the temperature maintained at from 2° to 5° C. overnight.

Readings were made as soon as tubes were removed from the icebox, and again after standing at room temperature for several hours. The latter check is necessary inasmuch as true cold agglutinins should disappear at average room temperature. Readings of positive tubes were graded 1-plus to 4-plus. A 4-plus reading, rare in our experience, is described by Horstmann and Tatlock as "a tight disk of red cells on inverting the tube three times," and a 1-plus as "a fine granular appearance on similar agitation." We depended upon naked eye readings, preferably by reflected sunlight.

I. STUDIES ON NAVAL HOSPITAL PATIENTS

SELECTION OF CASE MATERIAL.

During a 5-month period, sera were examined from all hospital patients in whom primary atypical pneumonia was clinically suspected. Thus a number of cases which proved to be acute catarrhal fever are included. Patients having lobar and bronchopneumonia, bronchitis, bronchial asthma, and related conditions, were tested in order to obtain evidence of the specificity of the reaction in atypical pneumonia. Cases of clinical pulmonary tuberculosis were also included in the series.

In addition further control sera were tested from as wide a variety of contagious and infectious diseases as was available in the hospital. Of particular interest were patients suffering from malaria, syphilis, or mumps complicated by orchitis, because previous reports had indicated the presence of high cold agglutinin titers in the sera of a few such cases. A few additional determinations were run on normal healthy controls among male members of the ship's company, and on a few patients with miscellaneous noncommunicable diseases.

FINDINGS.

Respiratory disorders.—In table 1 are listed the findings in 152 patients with respiratory diseases, upon whom a total of 376 tests were run. The most frequently repeated tests were in the atypical pneumonia group, in which 219 tests were performed upon 44 individuals.

As will be seen, among the 44 cases of primary atypical pneumonia, 29, or 64 percent, showed cold agglutinin titers of from 1:32 to 1:2,048. Of the remainder, 5 patients failed to show cold agglutinins, and in 10 cases the highest titer was from 1:4 to 1:16.

TABLE 1.—Cold agglutinins in respiratory diseases

Diagnosis	No. of cases	Negative	Maximum titer of cold agglutinins*									
			1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:512	1:1,024	1:2,048
Pneumonia, primary atypical	44	5	4	3	3	9	6	5	4	3	1	1
Pneumonia, primary atypical, unconfirmed	5					2	1	1		1		
Pneumonia, broncho-	2	1	1									
Pneumonia, lobar	5	5										
Catarrhal fever, acute	39	30	4	3	2							
Tuberculosis, pulmonary	10	5	1	3	1							
Pleurisy	4	2	1	1								
Bronchitis, acute	7	4		2	1							
Bronchitis, chronic	7	7										
Bronchial asthma	11	10	1									
Bronchiectasis	3	1	1		1							
Atelectasis	1		1									
Tonsillitis, acute and chronic	7	6	1									
Rhinitis, acute	2	2										
Empyema	1	1										
Miscellaneous	4	4										

* In this, and table 2, only cold agglutinin titers of 1:32 or above are considered significant.

In all of these cases there was positive x-ray and clinical evidence of primary atypical pneumonia. The temporal relationship between the appearance of cold agglutinins in high titer and the course of the disease has, in our experience, corresponded to the findings reported by others (1) (2) (3), except that significant titers have been obtained in several of our cases during the first

week of the disease. This finding was discussed in this journal by Heintzelman and Seligmann (4) in a report on the first 33 of the atypical pneumonia cases in this series.

Certain oscillation in cold agglutinin values, after a high titer had once become established, was noted in several of the cases in tests taken at 3- or 4-day intervals. In two of the patients this oscillation appeared to correspond with variations in the clinical course of the disease, whereas in others it could not be explained on this basis. In our cases no consistent relationship between cold agglutinin titer and severity of the disease could be established. Indeed in the only fatal case of primary atypical pneumonia in this series, 1:128 was the highest cold agglutinin titer obtained, whereas titers of from 1:512 to 1:2,048 were found in certain other patients who were ambulatory during the most acute phases of their illness and were never critically ill.

Included in table 1 are 5 patients with unconfirmed primary atypical pneumonia, who were admitted to the hospital with typical histories of recent attacks, but with negative clinical and roentgenographic findings. In these instances, 2 yielded titers of 1:32, and 1 each showed titers of 1:64, 1:128, and 1:512.

In the miscellaneous group, including bronchopneumonia, lobar pneumonia, acute catarrhal fever, pulmonary tuberculosis, pleurisy, acute bronchitis, chronic bronchitis, and bronchial asthma, cold agglutinin titers were in no instance higher than 1:16.

TABLE 2.—Cold agglutinins in nonrespiratory infectious diseases

Diagnosis	No. of cases	Maximum titer of cold agglutinins								
		Negative								
			1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:512
Malaria, benign tertian	20	19	1							
Syphilis	17	10	4	3						
Dengue	16	14		2						
Filariasis	13	11	1		1					
Jaundice, acute infective	10	8		1	1					
Gonorrheal urethritis	9	9								
Rheumatic fever	8	7		1						
Mumps, uncomplicated	5	4			1					
Mumps, with orchitis	4			1	2	1				
Dysentery, bacillary	3	1		2						
Diphtheria	2	2								
Strongyloidiasis	2	2								
Scarlet fever	1			1						
Chickenpox	1	1								
German measles	1				1					
Lymphogranuloma venereum	1			1						

Nonrespiratory infectious disorders.—A total of 135 tests was performed upon 113 patients in this category. The findings are listed in table 2, and need little explanation. In 20 cases of tertian

(vivax) malaria, the serum from but one case gave any agglutination reaction and that only 1:4. Of 16 dengue cases, 14 were negative, and 2 were positive 1:8. Similarly, filariasis, acute infectious jaundice, and uncomplicated mumps gave no significant agglutination. However of 4 cases of mumps complicated by orchitis, 1 showed a titer of 1:32, 2 had titers of 1:16, and 1 of 1:8.

Nine cases of acute gonorrheal urethritis gave negative results. Each of the nine patients had received at least 50 gm. of a sulfonamide, and 3 had shown evidence of mild intolerance and sensitivity to the drug.

Of 17 cases of active syphilis in primary or secondary stages, 10 yielded negative results, 4 had titers of 1:4, and 3 of 1:8.

Miscellaneous conditions.—A total of 45 tests was made on 37 patients exhibiting miscellaneous disorders other than those listed in tables 1 and 2. In 2 cases the titer was 1:8, in one case, 1:16, and the remainder were negative.

Single samples of sera from 14 healthy young male members of the ship's company, 10 of whom were colored mess attendants, were tested. Thirteen were negative, but 1 from the colored group gave a titer of 1:8.

COMMENT.

From an examination of table 1 it may be seen that no respiratory disease other than primary atypical pneumonia yielded a cold agglutinin titer higher than 1:16. The heavy vertical dividing line in table 1 between titers of 1:16 and 1:32 has been inserted to emphasize the fact that 1:32 is the lowest significant titer of cold agglutinins found in this series in primary atypical pneumonia. Lowering of the critical titer to 1:16 would cause inclusion in the serum-positive group of three additional cases of atypical pneumonia, but also of two cases of acute catarrhal fever, one of pulmonary tuberculosis, one of bronchiectasis, and one of acute bronchitis. On the other hand, raising the critical titer to 1:64 would not, as shown in the table, increase the specificity of the test to practical advantage. This finding is in substantial agreement with the experience reported by Turner and his coworkers (3).

The absence of a significant rise in cold agglutinin titer in tertian (vivax) malaria is of interest as it indicates at least that a rise in cold agglutinin titer does not occur with any regularity in this disease. The findings in mumps complicated by orchitis are interesting and furnish some confirmation of the findings of Turner and his associates. It is noteworthy that the single instance of high cold agglutinin titer encountered among the patients with mumps was the only such instance observed outside the primary

atypical pneumonia group.

The nine patients with gonococcus infection of the urethra were of interest because each man had received large doses of a sulfonamide, and three of the nine had shown signs of intolerance to this medication. No increased titer of cold agglutinins was observed, and hemolytic anemia was present in none of the patients.

The 17 cases of syphilis studied were all Kahn positive, and were either in the primary or secondary stage. No significant rise in cold agglutinin titers was detected, a finding of interest in relation to the results among Kahn-positive natives to be discussed in part II of this study.

II. STUDIES ON NATIVES IN YAWS-ENDEMIC AREA

SELECTION OF CASE MATERIAL.

During the course of this part of the study, sera were obtained from 10 native lepers. When 4 of these showed cold agglutinin titers of 1:32 or higher, blood samples from additional lepers were examined¹. Finally, when sera from 52 lepers had been accumulated, and an unexpectedly high percentage of increased cold agglutinin titers was encountered, it was noted that all of the 52 were Melanesians. Accordingly, samples of sera were obtained from 20 native lepers of white, brown, or yellow races, as well as from 34 nonleprous Melanesians. In addition, the sera of 15 nonleprous native whites and Malaysians were examined.

When in the course of the survey it became evident that leprosy was not the underlying factor in the production of abnormally high cold agglutinin titers among the black natives, standard Kahn tests were performed upon all of the serum samples in each group.

FINDINGS.

The findings are listed in table 3, and are based upon single serum determinations from each individual.

The first group studied consisted of 52 Melanesian lepers. Thirty-three, or 64 percent, of them had cold agglutinin titers ranging from 1:32 to 1:512. The number in each group having positive Kahns is shown. Thus of 19 Melanesian lepers with cold agglutinin titers below 1:32, ten had positive Kahn reactions and, among 33 in the high-titer cold agglutinin group, 18 were Kahn positive.

In the nonleprous Melanesian group, composed almost entirely of laborers and dock workers in apparently good health, 15 had

¹ We are indebted to Dr. Yves Rioux for his courtesy in furnishing blood samples from leprous patients in his charge.

TABLE 3.—*Cold agglutinins in native groups*

Race and condition	Number of individuals	Cold agglutinins	
		1 : 16 or less	1 : 32 or more
Melanesians:	86	38—(24)	48—(32)
Lepers:	52	19—(10)	33—(18)
Nonlepers:	34	19—(14)	15—(14)
Malaysians and Caucasians:	35	30—(2)	5—(2)
Lepers:	20	17—(1)	3—(2)
Nonlepers:	15	13—(1)	2—(0)

Note.—Figures in parentheses indicate number of individuals having positive Kahn reactions.

cold agglutinin titers from 1:32 to 1:1,024, and the remainder below 1:32. Of the 15 men with high cold agglutinin titers, 14 were Kahn positive; of the 19 below 1:32, 14 were Kahn positive.

Among 20 Malaysian, Chinese, and Caucasian lepers, only 3 presented cold agglutinin levels of 1:32 or above. Two of the 3 with high cold agglutinin levels were Kahn positive, as was 1 of the low cold agglutinin level group.

Of 15 nonleprous Malaysians and whites, 2 had high cold agglutinin titers. Neither of the 2 was Kahn positive, but 1 of the 13 with low cold agglutinin titers was positive.

COMMENT.

The fact that the Melanesian lepers showed a much higher incidence of increased cold agglutinin titers than the Malaysian and Caucasian lepers, suggests that leprosy was not the underlying factor in the occurrence of high titers in these cases.

Further, the finding of many unusually high cold agglutinin titers among healthy nonleprous Melanesians, and relatively few such titers among the group of nonleprous Malaysians and Caucasians, seemed to point to race as the responsible factor.

The Melanesian group, however, presents a high incidence of positive Kahn reactions, while the Malaysian and Caucasian group shows a much lower one. The factor accountable for the positive Kahn tests among the Melanesian natives is very likely yaws. It is known that yaws is endemic on this island among the Melanesian natives, nearly all of whom become infected in childhood. In most instances treatment sufficient to clear up clinical manifestations but not to influence the Kahn reaction is given.

Although positive Kahn readings in the entire group of Melanesians studied are about evenly distributed among cases with high and low cold agglutinin titers, nevertheless it is possible that yaws may be the factor responsible for the high cold agglutinin titers

in these cases. The 17 Kahn-positive cases of syphilis among service personnel are of interest here, in that none yielded a high cold agglutinin titer.

It is realized that the abnormally high cold agglutinin levels in the Melanesian group may be caused by some disease or factor entirely overlooked in this survey. However the diseases known to influence production of high cold agglutinin titers among service personnel are unlikely to be causative factors in the natives.

It would have been interesting to carry the study further and establish the role, if any, of yaws in this phenomenon, by study of clinically active cases, and if possible, of native Melanesian children who had not yet contracted the disease. We were unable to carry out such a study inasmuch as no cases of clinical yaws were available to us; the investigation was of necessity terminated when the groups listed above had been surveyed.

SUMMARY

1. The cold agglutinin titer of the blood serum was found to be conspicuously elevated in the majority of cases of primary atypical pneumonia of unknown etiology encountered among service personnel on a South Pacific island base during a 5-month period.

2. Presence of these agglutinins in serum dilutions of 1:32 and over was deemed strong evidence for the diagnosis of atypical pneumonia, since titers of this level were not encountered in other respiratory infections.

3. In a wide variety of nonrespiratory disorders affecting military personnel, including acute infectious jaundice, dengue, and tertian (vivax) malaria, cold agglutinins were either absent or present only in lower titer. One of four cases of mumps with orchitis showed cold agglutinins in a serum dilution of 1:32.

4. Unexpectedly high cold agglutinin levels were observed in a group of native Melanesians, although few such titers were found in a control group of native white and brown men. It is considered probable that the differences may be due to the prevalence of yaws among the Melanesians. Further studies of the influence of yaws, leprosy, and racial factors on cold agglutinin titers are indicated.

REFERENCES

1. PETERSON, O. L.; HAM, T. H.; and FINLAND, M.: Cold agglutinins (auto-hemagglutinins) in primary atypical pneumonias. *Science* 97: 167, February 12, 1943.
2. HORSTMANN, D. M., and TATLOCK, H.: Cold agglutinins; diagnostic aid in certain types of primary atypical pneumonia. *J.A.M.A.* 122: 369-370, June 5, 1943.

3. TURNER, J. C.; NISNEWITZ, S.; JACKSON, E. B.; and BERNEY, R.: Relation of cold agglutinins to atypical pneumonia. *Lancet* 1: 765-769, June 19, 1943.
4. HEINTZELMAN, J. H. L., and SELIGMANN, A. W., JR.: Evaluation of cold agglutination test in primary atypical pneumonia. *U. S. Nav. M. Bull.* 43: 433-437, September 1944.
5. YORK, W.: Quoted by STATS, D., and WASSERMAN, L. R.
6. STATS, D., and WASSERMAN, L. R.: Cold hemagglutination—interpretive review. *Medicine* 22: 363-424, December 1943.
7. DAMESHEK, W.: Cold hemagglutinins in acute hemolytic reactions in association with sulfonamide medication and infection. *J.A.M.A.* 123: 77-80, September 11, 1943.
8. HELWIG, F. C., and FREIS, E. D.: Cold autohemagglutinins following atypical pneumonia producing clinical picture of acrocyanosis. *J.A.M.A.* 123: 626-628, November 6, 1943.



AZOCHLORAMID IN WOUND INFECTION

The effects of azochloramid powder, sulfanilamide powder, and sulfafilm, alone and in combination, on beta hemolytic streptococci and staphylococci of human origin in artificial wounds of rabbits were investigated. The following results were obtained:

1. Hemolytic streptococci were present in infected wounds for two or four days and then disappeared without specific treatment.

2. Within an observation period of twenty-four to forty-eight hours sulfanilamide powder and sulfanilamide-impregnated film failed materially to reduce the number of hemolytic streptococci in such wounds.

3. Azochloramid powder and azochloramid-sulfanilamide powder caused a marked reduction in the number of organisms present.

4. The experiments did not reveal any synergistic action of azochloramid and sulfanilamide on hemolytic streptococci in such wounds.

5. Wounds infected with human pathogenic staphylococci were similarly treated. Sulfanilamide powder and sulfafilm proved to be ineffective. Azochloramid powder and azochloramid-sulfanilamide powder caused only a moderate and temporary reduction in the number of organisms.

6. Mixtures of azochloramid and sulfanilamide have been used with encouraging results in the treatment of wound infection in children.—NETER, E. R.; HUBBARD, R. S.; and LAMBERT, T. G.: Effects of sulfanilamide and azochloramid upon hemolytic streptococci and staphylococci in wounds of rabbits. *Am. J. Surg.* 65: 226-232, August 1944.

MENTAL MECHANISMS AND MORALE FACTORS OF NAVAL RECRUITS IN TRAINING

CRAWFORD N. BAGANZ
Lieutenant Commander (MC) U.S.N.R.

ROBERT J. MEARIN
Lieutenant (MC) U.S.N.R.

and
WALTER A. WOODS
Ensign D-V(S) U.S.N.R.

Morale has but one meaning for a military organization. It is the mental mechanism by which the consciously directed efforts of all the men succeed in attaining the goal of the organization; victory at the lowest cost in the shortest time. Anything which may thwart or hinder this effort is evidence of low morale. High morale is always accompanied by recognition of conscious effort on the part of the participant; knowledge that he is working toward the solving of a problem or the attainment of a goal.

Seldom does a man upon entering the military service have any understanding of his duties or responsibilities to his organization. He may have identified his participation with some vague purposes but he has not identified himself with any organized group or effort and has only scanty knowledge of what his participation is to be. This is particularly true in a nation where militarism is not an integral part of the individual's personality.

It is the primary concern of those charged with the orientation of men and the supervision of military personnel, to direct the thinking and actions of individuals toward practices and habits designed to accomplish morale by direction and integration. A group of men entering military service is composed of as many different personalities as there are members in the group. It cannot be too strongly emphasized that each man in the group is obsessed with his own particular points of view, his personal ambitions and his personal problems. For some, war is adventure; for others a chance to "get away from it all;" for still others there may be a pecuniary consideration. Some enter the service because of inevitability or sense of responsibility and shape their efforts toward creating or effecting their own particular niche in the military picture. Others set up barriers against the unpleasant elements of their situation. A few, however, appear to be con-

cerned with what they can personally do to attain victory at low cost. Despite popular opinion, many appear to be interested in a personal low cost with little regard for collective and aggregate low cost (both in lives and material).

The first step toward the attainment of "good" or "high" morale is the elimination of factors or conditions which cause low morale and the avoidance of situations which will reduce morale. It is the purpose of this paper to discuss four factors which are believed to be primary causes of low morale.

The factors which contribute most to this condition may be grouped into four major categories: Disorganization; special privileges; uncertainty; and lack of purpose.

DISORGANIZATION: ITS INFLUENCE ON MORALE

Disorganization portends confusion and lack of definite purpose. Men like to know that the vehicle on which they are traveling is able to make the journey. Despite excellent intentions no man can feel sure of performance or of his ability to attain his goal, if he lacks faith in the structure of his organization.

Most men recognize disorganization or poor organization no matter how limited their own administrative abilities may be. The obvious solution to faulty organization is reorganization. It is not within the province of this paper to discuss methods of organization but rather to point out that lack of it is an important contributing factor in the destruction of morale.

SPECIAL PRIVILEGES AS EFFECTORS OF LOW MORALE

The fundamental principle of American philosophy is equal opportunity. This is a principle which has carried over into our military organizations. It carries with it the assurance that each man has the same opportunity and is subject to the same discipline. This is a right which a man does not relinquish upon entry into service. He expects equal opportunity for advancement, an equal right to present his problems to his superiors, an assignment of duty in keeping with his qualifications, and equitable punishments.

The morale difficulties which arise from special privileges have two primary sources, i.e., (1) consciously granted special privileges, and (2) special privileges resulting from a concatenation of circumstances. The former must obviously be avoided. Men quickly distinguish unusual liberality to favored individuals or groups and the reaction is one of justifiable resentment.

The unconscious granting of special privileges by a fortuitous

combination of events is much more dangerous and less likely to be recognized as such. For example, ill considered liberties, hasty recommendations for promotion, and impromptu judgments create the illusion of inequality. All set the fortunate individual apart and effect serious damage to the morale of the others. The man who finds himself convicted by his superior before presenting his case is also the victim of unconscious special privilege.

The very nature of men is a complicating factor which adds difficulty to this problem of equal opportunity. Some are retiring and others are aggressively ambitious. It is as necessary to insure that the first group have equal opportunities presented to them, as it is to temper the overambitious personality.

UNCERTAINTY: MORALE REQUIRES A FACTUAL BASIS

The daily experience of practicing psychiatrists bears out the old adage "the worst fears are the fears of the unknown." If the converse is true, effort expended in the elimination of factors which produce uncertainty will do much to increase the morale of the individual members of any unit. As a result of our observations a number of causes of uncertainty were noted. Since the direct questionnaire method of determining relative frequency and order of importance of such causes is not feasible in a military organization, the factors are simply listed below.

1. Inadequate understanding of the relationship of the man to his unit.
2. Insufficient knowledge of duties, responsibilities, opportunities and penalties.
3. Ignorance of the general military purpose of his group.
4. Inequalities of pay or promotion.
5. Lack of communication with family and friends.
6. Concern over creature comforts.
7. Rejection of the individual by other members of his group.

LACK OF PURPOSE: MORALE IMPLIES A PURPOSEFUL BEHAVIOR

A definite purpose or objective, clearly understood by all, is one of the greatest factors in morale. These objectives of an organization are of two types; immediate and long range. A unit may function for a period of time with only the long-range type, i.e., "we are out to win this war;" but the sense of accomplishment following the completion of scheduled work is a requisite for continued high morale. It has been observed in this study that a concrete attainment is far more gratifying than routine progress toward the goal ideal.

CONCLUSIONS

Unfortunately, the problems presented here do not lend themselves to specific solutions or methods of treatment. They are instead "red-flag" warnings for responsible officers, things to be avoided. The existence of these problems reflects an unhealthy morale situation. It is the problem of each officer to determine when these problems arise (better still to assure that they never do arise), analyze the situation and determine the proper solution based on the facts disclosed.

It should not be forgotten that in wartime the majority of personnel have no military interests beyond winning the war; that as a group they cannot be expected after so brief a period of indoctrination, to be other than a "civilian navy."



TREATMENT OF MALARIAL CHILLS

By far the most uncomfortable symptom of malaria, from the standpoint of the patient, is the chill that usually precedes the fever. In an attempt to relieve these chills, a clinical trial was conducted in fifty cases of malaria, using calcium gluconate intravenously. Very satisfactory results have been obtained in most cases, with but few and mild untoward symptoms recorded.

Although reports of serious toxic effects from the therapeutic use of calcium gluconate intravenously are uncommon, the following precautions are nonetheless recommended: (a) Venipuncture should be carefully carried out, since extravasation of the calcium solution into the subcutaneous tissues may be followed by necrosis; (b) the injection should be given slowly; (c) the patient should remain recumbent for about fifteen minutes after the injection; (d) the use of intravenous calcium is definitely contraindicated in most cardiac cases, particularly those with arrhythmias and bradycardia, because of the initial vagus stimulating effects that may cause marked slowing down of the cardiac rate. However, some claim that no real danger exists, if the calcium is given slowly; (e) it is also contraindicated in patients who are receiving digitalis therapy, as calcium and digitalis have an additive, or synergistic effect on the heart.

Intravenous calcium gluconate, when given soon after the onset of the chill, produces a complete termination of the phenomenon within one to three minutes, in most cases.—STEVENSON, D. S.: Use of calcium gluconate in treatment of malarial chills. Puerto Rico J. Pub. Health & Trop. Med. 19: 602-613, June 1944.

DENTAL SURVEY IN THE MARSHALL ISLANDS

FRITS A. S. WINBLAD

Lieutenant (DC) U.S.N.

A survey of the dental conditions of natives on Majuro Island, Majuro Atoll, Marshall Islands, was undertaken in March 1944. These natives came under the control of the United States of America for the first time in February 1944, this atoll being the first of the Japanese mandated islands to do so. The background is Japanese exclusively, except for some American missionary influence, which ceased with the outbreak of hostilities and at best was somewhat sporadic. Some of the religious teachings, however, still remain.

The natives are Marshalese as to nationality and Micronesian as to race. Of those examined, men ranged between 5 feet 2 inches to 5 feet 8 inches in height. Women were slightly smaller, rarely weighing over 140 pounds. Their skin is normally smooth and dark brown, their hair is straight, occasionally wavy but not kinky, eyes are brown, and lips full but not negroid.

The natives live in pandanus-thatched huts with a frame of wood and a floor of pebbles, shells, or wood, on which mats are placed. There are usually two or more of these structures, one used for cooking, the other for sleeping and working. They are an intelligent people, wise in their own way of living and happy in it. They live in a land of plenty, and off that land. Fish are caught from the shore and from outrigger canoes. The land provides papayas, limes, breadfruit, coconuts, bananas, and the pandanus fruit. They raise hogs and chickens on the coconut shreadings. It might be truthfully said that the coconut is the staff of life to these people; it is the largest single factor of their diet.

Up until the present time the local "doctor," a native with some rather questionable scientific training in medicine, also acted as dentist. His dental therapeutics consisted of the application of creosote and acetylsalicylic acid to the aching tooth. No extractions were done. Oral hygiene, as we know it, does not exist. However the natives are familiar with such procedures, presumably having been instructed by missionary or Japanese teachers.

In the dental examination of 260 natives, including men, women, children, and infants, the following general observations were

made. The mandibular and maxillary processes were well developed, with many "heavy jawed" types. The gingival tissues for the most part were within normal limits for the individual, and occasionally some melanotic pigmentation was observed on the buccal mucosa. Tongues were normal in size and structure, with no glossitis or denudations, and palates were of average to lofty height.

There was caries and local reaction to diseased teeth, but it was fairly restricted in area. Exfoliation of roots, even in permanent teeth, was very prevalent, and there seemed to be a susceptibility to periodontoclasia. Calculus existed in varying degrees. There seemed to be a marked and fairly universal resorption of mandibular ridges in edentulous mouths. Teeth were exceptionally white in color even in higher age groups.

The bone in both the maxillary and mandibular processes was well developed and of a marked heaviness; there was no tendency toward receding chin. The full complement of teeth was easily accommodated, with little if any crowding of either the upper or lower anterior teeth, and no partially erupted or apparently retained deciduous third molars. The alveolar processes were prominent and well over the tooth crown in most instances. In children with deciduous and mixed dentitions the picture was consistent. Development of the arches anticipated the descending teeth, and although there were a few instances where there was lingual diversion of the lower incisors due to retained deciduous teeth, this was not alarming, as the deciduous teeth were loose and would probably be lost before the permanent teeth were entirely erupted.

In all age groups there were only two individuals who could be classified as having a slightly abnormal overbite and one whose jaw development was slightly prognathous. In general the others were close to being ideal. This shows the natural development of the teeth and jaws of these people; it does not include those instances in which pathologic factors had obliterated the natural occlusal picture; that is, when periodontoclasia had caused tooth drifting and mobility, or missing teeth had destroyed the original relationship. This group was not more than 10 percent of the total number examined.

Gingival tissues were normally a tannish pink in color and seemed highly tolerant in most cases, for only in the presence of extremely heavy deposits of calculus or when roots were infected were the expected gingival reactions of hypertrophy, redness, and engorgement present. No signs or symptoms of Vincent's infection or of other stomatitis were found. There were, however, two cases of leukoplakia, both occurring in older men, one of whom

had numerous posterior stumps and the other only a few anterior teeth. In a few instances there was diffuse melanotic pigmentation, usually bilateral, on the buccal mucosa.

The palates were smooth and well formed, in general, with a medium to high vault. There was no evidence of unjoined palatal processes, and no tori palatini. In one man over 70 years old who showed evidence of yaws, a perforation of the palate, $\frac{1}{4}$ inch in diameter, was found, located posteriorly and approximately in the midline.

In the younger age groups there was pit and fissure caries, which when present was active in the permanent as well as in the deciduous teeth. From adolescence on, an unusual type of caries was present. It somewhat resembles cervical erosion as we know it, but differs in that it usually surrounds the tooth as a band, and is usually seen in the vicinity of the cemento-enamel junction. Cervical erosion may be caries-free, but this type, even in its early stages, showed dark brown leathery decay. There seemed to be some indication that it starts on the labial surface and then quickly surrounds the entire tooth. We say *quickly*, because in some mouths where the process was noted, a very slight difference in the depth of decay existed on the lingual and the labial surfaces. Also slight carious areas on the labial surface were well supported by decalcified areas on the mesial and distal surfaces with extensions onto the lingual surface.

The incidence of this type of caries seemed to be higher in the adolescent group, yet this is difficult to say as stumps were very prevalent in the older age groups. In the older age groups the teeth were either caries-free or were stumps.

These stumps were dead teeth. In very many instances there were 12 or 15 in one mouth. Pyogenic involvement of the supporting tissues followed, and it was not uncommon to find the tooth root floating in a well of pus. However cellulitis was not observed, nor was lymph gland involvement in the cervical or the submaxillary regions noted. The localization of these processes was quite remarkable.

It seems that nature has a way of helping out when scientific methods are not available; particularly was this true in the exfoliation of these stumps. Very few residual deciduous teeth were noted, and although permanent stumps were numerous, there was definite evidence that exfoliation was taking place.

Periodontoclasia was markedly prevalent, with such local manifestations as calculus deposits, recession, motility, drifted teeth, alveolar crest resorption, pocket formation, and gingival hypertrophy and engorgement. The age incidence seemed to be slightly

lower in the women, some showing diseased gingivae in their late twenties, whereas the men usually were unaffected until forty.

In the age group below 25, calculus was hardly ever present. In consistency, the calculus was yellow, hard, and coarse, and seemed to be most prevalent in the lower anterior lingual region, and on the buccal surfaces of the posterior teeth, although it was also seen on the palatal surfaces of the upper posterior teeth.

Of particular interest in the edentulous mouths was the universality of marked resorption of the mandibular ridge. The maxillary ridge for the most part was even, and showed little resorption; however, even in partially edentulous patients in whom the lower posterior teeth were missing, marked absorption had taken place and the ridges were almost even with the floor of the mouth. In the edentulous mouth the temporomandibular articulation was observed. One expects to find changes under these conditions, but three women 60 to 70 years of age were observed, each showing the same scraping and mesial ride of the condyle upon opening and closing of the mouth. The noise of the scraping was so loud and marked that standing 3 to 5 feet away from them it was still noticeable. There was no complaint of pain or discomfort.

On an S.S. White shade guide, the coloration of the teeth ranged in the blue-white and yellow-white group. Shades 20 and 21, L and M, were the most prevalent among the group as a whole. In three instances crown and bridgework of a sort was found. Queries revealed that it was Japanese in origin, and had been done in Japan or on Jaluit. One of these cases was particularly interesting in its "tin can" crown construction on two upper lateral incisors. The labial surfaces of these crowns were made of 10- or 12-carat gold; the lingual of a tin alloy. In numerous instances the entire Hutchinsonian triad was present. In only one mouth, however, were all three, the peg laterals, notched centrals, and mulberry molars, present. Hypoplasia was observed in one instance, and this was limited to the anterior teeth. In children where the early loss of the first deciduous molar had occurred, the underlying bicuspid was erupting prematurely.

In general, however, the natives had white, well calcified teeth. When caries was present it was largely of the "band" type. Stumps were plentiful, and yet in the older natives there were many complete dentitions caries free.

How representative is this group, 260 natives of all ages, of the Marshalese, only further investigation will reveal. Whether the inferences as to the possibility of a "band" type of caries being peculiar to this group of people are warranted, is impossible to say, but the conditions found here invite further investigation.

THE DENTAL CORPS COMES OF AGE

FRANCIS G. ULEN
Captain (DC) U.S.N.

Unlike Minerva who sprang full panoplied from the head of Jove, the Dental Corps of the Navy has achieved its majority attended by all the growing pains of adolescence, beset by all the fears and doubts of youth. Scant heed was given to the birth of this scion of dentistry when on 22 August 1912 the Congress of the United States enacted legislation authorizing the appointment of assistant dental surgeons to be a part of the Medical Department of the United States Navy. Few indeed were they who at that time, with prophetic vision, could have foretold the growth of this infant corps from its modest inception to a size which today dwarfs the entire Medical Department of the pre-Pearl Harbor Navy.

In order that the growth and development of the Dental Corps may be better understood, it is desirable that the salient features in the development of its parent organization should be considered. For this reason a brief résumé of the history of the Medical Department is included.

In December 1775 the Continental Congress decided to build thirteen ships. This may be regarded as the beginning of the United States Navy. Two months later, on 7 February 1776, the State of Massachusetts caused ten sloops of war to be constructed, and further provided that each should be supplied with a ship's surgeon. In the beginning the choice of the ship's surgeon was left to the discretion of the commanding officer. Later the Continental Congress recommended to the several states that such candidates as applied for the position of ship's surgeon be examined to determine their fitness to discharge the duties of that office. The surgeon, surgeon's mate, and "loblolly" boy comprised the medical personnel of the ship. There was no formal establishment of a medical department in either the ship or the Navy as a whole, and little or no need existed for such. The surgeon was a part of the ship's company. In the main each ship acted independently under a "roving commission," each an armed force unto itself. Arnold's gunboats on Lake Champlain were the sole example of a force of war vessels entering combat under one commander.

On 27 March 1794 Congress determined that: "*Whereas the depredations committed by the Algerine Corsairs on the commerce of the United States render it necessary that a naval force should be provided for its protection, . . .*" such a force should be procured. This act authorized the construction of men of war for this purpose and further provided for surgeons and surgeon's mates "who shall be appointed and commissioned as other officers of the United States are."

A second step in the development of the Medical Department came on 27 March 1804 when "The President was authorized to attach to the Navy Yard, and vessels laid up in ordinary . . . one surgeon or surgeon's mate, . . . ;" this authorization was an early provision for short duty of Naval officers.

Naval hospitals were first established as a matter of expediency and without Congressional authority. Edward Cutbush, surgeon of the *U.S.S. Constellation*, then operating against the Barbary States, established the first U. S. Naval Hospital in Syracuse, Sicily, in 1806. Surgeon Lewis Heermann, realizing the necessity for more adequate medical care of Naval personnel, acting on his own authority, established a second unofficial hospital in New Orleans in 1810.

The then Secretary of the Navy, Paul Hamilton, in a letter to the House Naval Committee written in 1810, urged the authorization of such hospitals and expressed ". . . the hope of soon seeing a Greenwich commenced in our city" The following year, on 26 February 1811, they were authorized, and the Secretaries of the Navy, Treasury, and War were named as "Commissioners of Naval Hospitals."

An act for the better organization of the Medical Department of the Navy, approved on 24 May 1828, carried several provisions of great importance to the growth and development of that department. This act abolished the title of "surgeon's mate" and substituted that of "assistant surgeon." It provided for the examination of candidates for the office of assistant surgeon by a Board of Naval Surgeons and further provided that no person should be appointed as a surgeon unless he had gone through the grade of assistant surgeon, served a minimum of two years at sea, and passed an examination to determine his fitness for advancement.

Another feature of importance in this act was the creation of the office of fleet surgeon. The act provided that "The President may designate among the surgeons in the Service, and appoint to every fleet or squadron an experienced and intelligent surgeon who shall be denominated 'Surgeon of the Fleet' and shall be Surgeon

of the Flagship." This established the first fleet staff office, a precursor to the office of Surgeon General.

An unsatisfactory arrangement whereby fleet medical procurement was concentrated in New York, while the medical officer of the Navy Yard in Washington passed upon questions of a medical nature for the department, led to the founding of the Bureau of Medicine and Surgery by Act of Congress in 1842.

Surgeon W. P. C. Barton was appointed as the first Chief of the Bureau. In October 1842 the order was issued that "the Medical Officers of the Navy will make all communications and requisitions connected with their duty direct to the Chief of the Bureau of Medicine and Surgery of this Department, and will obey all orders and instructions which may be issued by that bureau in which only their requisitions are required to be approved and executed."

The first hospital ship of which we have any accurate record was improvised by converting a vessel captured from the Confederacy by Admiral Porter. It was a sidewheel river steamboat which was refitted, rechristened the *Red Rover* and placed under the command of Fleet Surgeon Ninian Pinkney.

The act of 3 March 1871 provided that the Chief of the Bureau of Medicine and Surgery should have the title of Surgeon General of the Navy and the relative rank of commodore. In 1897 the rank was advanced to that of rear admiral.

Additional laws and regulations have greatly enlarged the scope of the Medical Department's activities and have permitted its development to its present stature.

The Act of Congress which provided for the appointment of dental surgeons in the Navy marked the successful termination of intermittent efforts over more than half a century. As early as 1859, shortly after the recognition of dentistry as an independent profession,¹ an editorial appearing in the *American Journal of Dental Science* advocated that the Congress be memorialized upon the desirability of appointing dentists for service in the Army and Navy.

Some agitation for the establishment of a dental corps in the

¹ The antiquity of dentistry is attested not only by the discovery of numerous dental artifacts by various archeologic expeditions but also by written record. The oldest known book on dentistry, *Artzney Buchlein*, was published anonymously in 1530. It quotes from Mesue (A. D. 857) physician to the caliph Haroun al-Raschid, who records the filling of teeth with gold foil at that time. It was well into the Nineteenth Century, however, before a formal course of instruction in dentistry existed. Prior to that time the only means of acquiring a knowledge of dentistry was by apprenticeship to a practicing dentist. In 1840 the refusal of medical schools to provide facilities for dental instruction led to the establishment of the Baltimore College of Dental Surgery, with formal courses of instruction in dental education. This established dentistry as a profession, related to, but apart from the practice of general medicine.

Navy was undertaken in 1901, in which year Congress authorized the employment of contract dental surgeons in the Army. However, no real effort toward this end was made until the then Surgeon General, P. M. Rixey, in his report of 1 October 1902, proposed that a dental service be provided for the Navy. During this same year a bill was introduced, but not considered by the Congress, which authorized the employment of contract dental surgeons in the Navy.

The act approved 22 August 1912 provided for the appointment of dental surgeons to be a part of the Medical Department of the Navy but it did not specifically establish these appointees as the Navy Dental Corps. Moreover, it stipulated drastic limitations in the number, rank and professional activities of dental officers. Thus there were to be no more than 30 dental surgeons in the Navy, their rank was to be limited to that of lieutenant, junior grade, and their professional activities were to comprise only those measures which would "most effectively and economically preserve the teeth of the personnel and insure physical fitness. . . Prosthetic procedures, such as gold, bridge or crown work" were "not contemplated as a part of the work of a dental officer".²

Despite these limitations it was required that a candidate for appointment as a dental surgeon in the Navy should be trained in the several branches of dentistry, and to be appointed, should successfully complete theoretical examinations, both written and oral, in all branches of dentistry, as well as practical or clinical examination in operative and prosthetic procedure.

In addition to the thirty officers who were to become a permanent part of the Navy, this act authorized the Secretary of the Navy to appoint, for temporary service, suitably qualified dental surgeons when necessary to the health and efficiency of the Naval service, provided that the total number of dental officers, including those permanently appointed, as well as those appointed for temporary service, should at no time exceed the proportion of one dental officer to each one thousand of the authorized enlisted strength of the Navy and Marine Corps.

The need for a trained nucleus of dental officers, capable of expansion to meet the requirement of a wartime Navy, was recognized by the Congress in 1913, when legislation was enacted authorizing the organization of a Navy Dental Reserve Corps to be operated under the provisions of the act approved 22 August 1912 for the organization and operation of a Navy Medical Reserve Corps. It differed only in qualification requirements of the ap-

² Manual of the Medical Department of the United States Navy, 1914 (par. 1032, 1033).

pointees, who were to be dental surgeons and graduates of reputable schools of medicine or dentistry instead of graduates of reputable schools of medicine.

The next step in the development of the Dental Corps came with the approval by the Congress on 29 August 1916 of an act authorizing the President of the United States to appoint and commission, by and with the advice and consent of the Senate, dental surgeons in the Navy at the rate of one for each one thousand of the authorized enlisted strength of the Navy and Marine Corps. This act specified that these officers should constitute the Dental Corps of the Navy. Prior to its passage it had been customary to designate dental officers by their rank, followed by the letters M.C.D.S., the abbreviation for Medical Corps Dental Surgeon. Since that time the D.C., signifying Dental Corps, has been customarily employed.

This act, which specifically established the Dental Corps as such, also provided for the removal of some of the limitations of rank, which had previously applied to the dental officers. Dental surgeons who had completed more than 5, but less than 20 years' service could be promoted to the rank, and have the pay and allowances of lieutenants. Those who had completed 20 years of service might have the rank, pay and allowance of lieutenant commander, provided that at no time should the number of these officers exceed a total of ten.

The establishment of a dental service in the Navy, and such action as had been taken subsequently and relative thereto, was coincidental with a quickening interest in all things military and naval. There was a growing conviction throughout the world that war in Europe was inevitable. The assassination of the Austrian Archduke, Francis Ferdinand by a Serb at Sarajevo, on 28 June 1914 and the refusal of Serbia to meet the demands of the Austrian ultimatum which followed resulted in a state of war between these countries as of 28 July 1914 and precipitated World War I. However despite the conviction which was current in certain circles that the United States would be forced to participate in this war as a belligerent, and despite the nearly 3 years that intervened between the beginning of the war and our entry, the Navy found itself, in many respects, woefully unprepared when on 6 April 1917 Congress declared that a state of war existed between the United States and the Central Powers.

Perhaps of all components of the Navy, the Dental Corps was the least prepared to meet the gigantic Naval expansion program which was immediately initiated. The Corps was limited not only in numbers but also in experience. The total number of dental officers serving in the Navy at that time was forty-one. In addi-

tion there were 13 officers of the Naval Reserve. The most experienced of these had less than 5 years' service as commissioned dental officers. They had spent little or no time at sea. None of them had served as dental officers in combat.

HONORS FOR DENTAL OFFICERS

In view of the youth and inexperience of the Corps it is indeed remarkable that during World War I it should have achieved its enviable record of accomplishment both at home and abroad, ashore and afloat. The first commissioned officer of the United States Navy to meet his death in the land fighting overseas was a dental officer, Lieutenant, junior grade, Weeden C. Osborne who was killed in action on 6 June 1918 near Bois de Belleau, France, while carrying a wounded officer to a place of safety. Both of these officers were attached to the 6th Regiment of United States Marines. Lieutenant Osborne was posthumously awarded the Congressional Medal of Honor and the Distinguished Service Cross for this intrepidity and extraordinary heroism in actual conflict with the enemy. Later a destroyer was christened the *U.S.S. Osborne*, the first vessel in the Navy to be named in honor of a dental officer.

Another dental officer to be signally honored was Lieutenant, junior grade, Alexander Gordon Lyle, who received the Congressional Medal of Honor for extraordinary heroism and devotion to duty while in actual combat with the enemy in the Verdun sector on 23 April 1918. At this time Lieutenant Lyle was attached to the 5th Regiment of United States Marines. In addition to the Congressional Medal of Honor, and for gallantry in action in the Soissons sector, Lieutenant Lyle was twice cited for the U. S. Army Silver Star Medal.

The Navy Cross was awarded to Lieutenant, junior grade, Cornelius Henry Mack, an officer of the Dental Corps, for extraordinary heroism in the action at Bois de Belleau on 12 June 1918 while serving with the 6th Regiment of Marines. In addition to the Navy Cross, Lieutenant Mack was cited five times for the U. S. Army Silver Star Medal and also received the Croix de Guerre, Gold Star, from the French Government.

A fourth dental officer to be decorated was Lieutenant, junior grade, Harold Arthur Badger, who was cited for the U. S. Army Silver Star Medal for gallantry in action against the enemy in the Champagne sector. Lieutenant Badger also received a letter of commendation from the Secretary of the Navy, as well as the Croix de Guerre, Gold Star, from the French Government.

Of less dramatic appeal than these acts of individual heroism but of prime importance to the health and welfare of the men of the Navy was the unremitting effort of the Corps in helping to keep the most men at the most guns the most days possible. The magnitude of this task can be more fully comprehended when one realizes that during World War I the number of dental officers on duty in the Navy rose to an unprecedented total of 500, an increase of something more than twelve hundred percent. All of these officers were kept continuously occupied in rendering the Navy and Marine Corps dentally fit to fight.

DENTAL CORPS EXPANDED

The revulsion of feeling which was concurrent with the demobilization of the World War fighting forces was not without effect on the Corps. The greater financial remuneration promised by civil practice was most appealing. Promotion would of necessity be retarded. The career of a Naval dental officer had lost something of its appeal. Perhaps in anticipation of this feeling, on 1 July 1918 Congress approved an act amending the laws pertaining to the Dental Corps. This act authorized the pay and allowances of commander and captain, but not the rank, for officers of the Corps. Despite this recognition of the increased importance of dentistry to the Naval service, shortly after the war the Dental Corps had fallen below its authorized strength. This condition was remedied a short time later.

The next step of importance in the development of the Corps came with the removal of the limitation of dental service to be rendered. In 1920 Rear Admiral W. C. Braisted, then Surgeon General of the Navy, authorized prosthetic restorative treatment as a part of the professional activities of the dental officer. This action placed the dental service of the Navy on a footing equal to that of civilian practice.

In 1922 Rear Admiral E. R. Stitt, who had succeeded Rear Admiral W. C. Braisted as Surgeon General, caused a school of dentistry to be included as a division of the U. S. Naval Medical School. Courses in Naval dental medicine were officially started on 3 February 1923.

Although postgraduate instruction and refresher courses for older officers and primary training for dental technologists were included in its curriculum, the prime objective of the dental school was, and has continued to be the indoctrination of newly commissioned dental officers and their instruction in those collateral duties which are a function of the Naval dental officer but not of

the civilian dentist. Concurrent with the establishment of dental instruction at the Medical School in 1922, a Division of Dentistry was established as a part of the Bureau of Medicine and Surgery. Prior to that time the only representation that the Corps had had in the Bureau was one dental officer assigned as assistant to the personnel officer.

The so-called Equalization Bill which was approved 10 June 1926 "To provide for the equalization of promotion of officers of the staff corps of the Navy with officers of the line" further removed limitations in the rank of dental officers. This act provided for the ranks of captain and commander in the Corps. An effort was made at this time to include the rank of rear admiral for dental officers but this failed to become a provision of the bill. The act also provided for the selection of officers of the staff corps in a manner similar to the selection of officers of the line.

As a result, on 3 November 1926, the first board for the selection of officers of the Dental Corps to the rank of commander met in Washington. This board, except for the recorder, was composed of rear admirals of the line, a custom which was continued until there were enough ranking dental officers to form selection boards.

Further recognition of the Dental Corps came in 1927 with the revised issue of the Manual of the Medical Department which provided that one of the eight professional services of a Naval hospital should be a dental service, and that the dental officer should have the status of a chief of service.

Due to economic reasons the Naval Dental School was closed as such in 1932, but continued to function as the dental service of the Naval Hospital at Washington until the latter part of 1935 when it was reopened as a school, still as a part of the Naval Medical School.

Of tremendous importance to the strength of the Corps and the efficiency of the dental service in the Navy was the Act of Congress approved 22 July 1935 which provided for an increase of dental officers to the ratio of one for each five hundred of the actual number of officers and enlisted men in the Navy and Marine Corps. A cursory examination of the provisions of this act might seem to indicate that the strength of the Corps had been doubled but such was not the case.

Prior to this act provision had been made for the appointment of dental officers in the ratio of one to one thousand authorized strength of the Navy and Marine Corps. The Dental Corps had been kept recruited to this level, but the actual strength of the Navy had not been kept up to its authorized strength. These facts

had resulted in the provision of dental officers in a ratio in excess of one to one thousand of the actual strength. The immediate result of the act was to increase the allowed numerical strength of the Corps from 186 to 234 officers.

On 20 June 1935 the Secretary of the Navy, by executive order, established the Naval Medical Center at Washington to consist of the Naval Medical School and the Naval Hospital. Shortly thereafter Rear Admiral P. S. Rossiter, Surgeon General of the Navy, recommended to the Secretary that the Dental School be established as a special activity under the jurisdiction of the commanding officer of the Naval Medical Center, to be administered in the same manner as the Naval Hospital and the Naval Medical School. In consequence of this recommendation, on 17 March 1936 the Naval Dental School became an entity of the Naval Medical Center, with Commander John Volney McAlpin of the Dental Corps in command. This was the first instance of a Naval dental officer being ordered to command.

The Naval expansion program which immediately preceded the entry of the United States into World War II was reflected in the Dental Corps by a marked increase in personnel, both regular and reserve. Thus we find that on 7 December 1941, when Japan struck at Pearl Harbor, the Corps consisted of 336 regular and 348 reserve officers. This was not the inexperienced Corps which had entered World War I. Many of the more senior officers were veterans of that earlier conflict; others had campaigned in China, Nicaragua and Haiti. Some were familiar with the peculiar requirements of field dentistry. A few had been trained in war plans and logistics. All realized the enormity of the task which lay ahead.

Among the reserve officers also, veterans of former wars were to be found. A comparatively large number of these reserves had been on continuous active duty for extended periods of time before war was declared. In some instances these periods were in excess of two years. These were experienced officers.

Again in the vanguard of those who have made the supreme sacrifice in the present war are to be found the names of officers of the Dental Corps. Lieutenant Commander Hugh R. Alexander was trapped below decks on board the ill fated *U.S.S. Oklahoma* at Pearl Harbor. Although himself unable to escape, he continued until the last in aiding other and smaller men to safety through a porthole.

Lieutenant Commander Thomas E. Crowley, dental surgeon of the *U.S.S. Arizona* was also killed in action at Pearl Harbor. Later

a destroyer escort was christened the *U.S.S. Crowley* in his honor.

Lieutenant Commander Laurice A. Tatum was killed in action aboard the *U.S.S. Wasp* in September 1942. Lieutenant Commander Tatum was posthumously awarded the Silver Star for gallantry in his last action. On 7 August 1943 the destroyer escort *Tatum*, named in honor of this dental officer, was launched at Orange, Texas.

Commander Wadsworth C. Trojakawski, dental surgeon of the *U.S.S. Lexington* was killed in action in the South Pacific on 12 June 1942.

The *U.S.S. O'Reilly*, also a destroyer escort, was so named to honor the memory of Lieutenant Edward J. O'Reilly, dental surgeon of the *U.S.S. Astoria* who was killed in action when his ship was sunk in the South Pacific on 9 August 1942. The Order of the Purple Heart was posthumously awarded to Lieutenant O'Reilly.

The foregoing is but a partial list of the officers of the Corps who have received honors, decorations and commendations in the war in which we are now engaged. It includes only the names of those who had been killed in action at the time this article was written. As it must remain incomplete until the termination of the war, full recognition cannot be given to all those who are deserving.

In this, as in the first great war, there has been a tremendous expansion in the Dental Corps. The total number of dental officers on active duty will again reach an unprecedented peak. It is a far cry from the thirty dental officers originally authorized in 1912 to the number now on duty—a truly remarkable growth. As in World War I these officers are fully occupied in rendering a service to the fighting forces which enables them better able to meet the terrific requirements of physical combat at sea, in the air, and in amphibious warfare.

The rapid expansion of Naval training facilities, the establishment of dental clinics of 50 operating-room capacity, the employment of a daily 2-shift schedule to meet the increased need for dental service at Naval stations—all these and myriad other dental problems had so increased the work of district medical officers that early in 1942 it was decided to assign dental officers for duty with the district medical officer in certain of the larger Naval Districts as assistants for dental affairs. The virtue of this decision was soon manifest by an improvement in morale of dental officers, a more equitable distribution of both dental officers and dental technologists, and an increased efficiency of dental organizations within the districts.

Later, on 16 October 1942, the Chief of the Bureau of Medicine

and Surgery recommended to the Chief of Naval Personnel that in order that the Bureau of Medicine and Surgery should be kept informed on matters pertaining to dental affairs in the districts, the complement of each Naval District be changed to include one dental officer of the rank of captain to act as district dental officer.

Of prime importance to the morale and esprit de corps of the dental officers of the Navy was the act which authorized the rank of rear admiral in the Dental Corps. This act was approved as of 17 December 1942, and shortly thereafter a selection board of rear admirals of the line and of the Medical Corps was convened to consider the records of captains of the Dental Corps who were eligible for promotion. As a result of the recommendations of this board, Captain Alexander Gordon Lyle was promoted to the rank of rear admiral, to rank from 13 March 1943. This was the same officer who had received the Congressional Medal of Honor for extraordinary heroism at Verdun.

On 11 February 1944 the Surgeon General advised the commandants of all Naval Districts that, although district dental officers had been assigned to most Naval Districts and their functions had, in a sense, become apparent, it was desired to establish as specifically as possible the basic scope of their duties. He further stated that these duties were to include acting in an advisory capacity to the commandant in dental affairs, and under delegated authority acting for him regarding dental planning, assignments, transfers, and certain other matters. The district dental officer was also to inspect existing dental facilities and to report his comments, suggestions, and recommendations resulting from these inspections to the Bureau of Medicine and Surgery. Inspection of dental activities in the Navy has been further facilitated by the assignment of Rear Admiral Lyle to duty as Inspector of Dental Activities of the Navy as of 28 September 1943.

The establishment of a Dental Section in the Headquarters and Service Company of the Medical Battalion of Marine Divisions of the Fleet Marine Force³ marked a further advance in Naval dentistry. This section is a highly mobile field dental facility, including both operative and prosthetic services. It can be used in whole or in part at any point within the area of activity of the division. It is in addition to the dental components of the various medical companies and regiments which comprise the division. Concurrent with the establishment of this dental section, the senior dental officer of the division was designated as division dental surgeon and assistant to the division surgeon.

³ ULEN, F. G.: Establishment of Dental Section in Medical Battalion of Marine Divisions of Fleet Marine Force. U. S. Nav. M. Bull. 42: 581-583, March 1944.

The most recent recognition of the growing importance of Naval dentistry came, when on 17 January 1944 the Commander of the Seventh Fleet issued orders to Commander Louis D. Mitchell, assigning him to duty on his staff as Fleet Dental Officer, Seventh Fleet, with duties in connection with inspection of dental activities of that organization. Thus in 1944 we find in dentistry a repetition of the action taken on 24 May 1828, when an "experienced and intelligent surgeon" was "denominated Surgeon of the Fleet."



ABUSE OF REST IN CARDIOVASCULAR DISEASE

1. Extreme restriction of body movement causes increased mortality in animals with experimental myocardial injury.

2. There is no proof that rest in bed carried out for many weeks after symptoms have disappeared is of value in the physical management of the patient with congestive failure, angina pectoris or myocardial infarction. The available evidence, while perhaps not conclusive, points to the contrary, and more especially so if the recumbent posture is enforced while the patient is kept in bed.

3. From the psychic standpoint there is a definite disadvantage in the enforcement of a rigid regimen after the acute phase of the illness has subsided.

4. Until more definite information is available, the following tentative suggestions are offered for a plan of treatment which obviously requires modification according to the status of the individual patient:

(a) Persons with congestive heart failure should be allowed out of bed for several hours a day, as soon as severe dyspnea at rest has subsided.

(b) Following myocardial infarction, recumbency should not be prescribed for a longer period than two to three weeks after the more acute and alarming symptoms have subsided. The recumbent position should not be enforced on patients who are more comfortable sitting. Other things being equal, it would appear wise to allow elderly patients out of bed sooner than younger ones.

(c) Rest in bed for more than a day or two at a time probably has no place in the treatment of angina pectoris except in those patients who are especially liable to develop myocardial infarction in the immediate future, as indicated by increasingly frequent and prolonged attacks at rest.

(d) In all patients with the severe forms of heart disease activity should be kept below the symptomatic threshold, i. e., should be less than that amount which induces dyspnea or pain.—HARRISON, T. R.: Abuse of rest as therapeutic measure for patients with cardiovascular disease. *J.A.M.A.* 125: 1075-1077, August 19, 1944.

CEREBRAL SYMPTOMS IN MALARIA

SYLVESTER McGINN

Lieutenant Commander (MC) U.S.N.R.

and

JOHN T. B. CARMODY

Commander (MC) U.S.N.R.

At this base hospital, symptoms of cerebral origin in patients suffering from malaria have been the most serious and frequent complications encountered. Because this malarial pattern seems inadequately described in the literature, our experience with it is recorded in order to emphasize its importance.

It is thought preferable to consider these cases as of patients having cerebral symptoms of malaria rather than as having cerebral malaria. The latter condition is usually considered to occur in malignant tertian malaria and caused by the *Plasmodium falciparum*, whereas our cases were primarily of the benign tertian type in which *Plasmodium vivax* was the causative agent. In the few instances in which the brain could be examined, it was impossible, moreover, to demonstrate pigmentation or obstruction of the capillaries with parasite-filled corpuscles, pathognomonic of typical cerebral malaria.

Delirium and mental confusion are commonly observed in malaria, especially during or following a chill and sometimes during atabrin therapy. Headaches and restlessness are noted in many patients and a few have speech difficulties. These are symptoms of cerebral irritation which may arise from toxic, congestive, thermal, or parasitic causes. There are no consistent neurologic objective symptoms in these conditions, although nystagmus is occasionally observed.

The cases comprising the subject of this report differ from this description in that convulsions or coma, either separately or together, were present and persisted for an appreciable period of time.

Sixteen patients had cerebral symptoms as the most prominent feature of their illness. An additional group of ten was seen, all of whom recovered, but because of insufficient data they are not included in this report. The 16 patients comprising this study were admitted in February, March, April and May, eight of them being admitted in March. Recovery took place without residuals in

all except three. These three died and were examined postmortem. All of the patients had *P. vivax* in their blood stream and two had in addition *P. falciparum*. Eight of the patients had convulsions and in some instances were admitted with the diagnosis of epilepsy. One man had many violent convulsions recurring over a period of nine days. In most of the other patients, however, there was an initial convulsive seizure, sometimes two or three, which was followed by a state of coma. Fifteen patients were unconscious for a period of from a few hours to five days, and the sixteenth died suddenly in his second convulsion.

The onset of this type of symptoms in one instance was when a man returning from the mess hall walked blindly into the side of a building and fell in a mild convulsion. In another the patient became unconscious while at stool, and several others had severe convulsions occurring suddenly while talking to friends. The cerebral symptoms occurred in one patient on the fifth day of a routine course of quinine and atabrin therapy, and in two others five and two days respectively after the completion of a course of treatment. Information as to prophylactic therapy is not available but since these men were all with troops in the malarious areas, it can be assumed that they had been on routine atabrin preventive treatment. It is known that six men had received full courses of therapy for previous attacks of malaria, one having as many as eight, the number of attacks in the others being uncertain.

Neurologic examinations failed to show consistent abnormalities. The spinal fluid was examined in half the number of the patients and except for a slightly increased pressure on three occasions, it was found to be normal. The blood nonprotein nitrogen was normal in 5 patients and the blood sugar was also within normal limits in all except one of the fatal cases, in which instance it reached 200 mg. Complete blood examinations were made on eight patients, four of whom showed a moderate secondary anemia and three had a leukocytosis. Two electrocardiograms made during the period when the two patients were comatose, were normal.

Treatment was started immediately in each of these cases. Where restlessness was prominent, paraldehyde was given rectally. The results were only fair. The intravenous administration of quinine was necessary in all except one of the 16 patients and on a number of occasions provided prompt relief. One man had had three convulsions but was rational and able to take oral medication. In two cases $7\frac{1}{2}$ grains of quinine dihydrochloride was put into 500 cc. of 5-percent dextrose solution, and in the remaining cases 15 grains of the drug was added to 1,000 cc. of 5-percent dextrose solution. The fluid was administered very slowly by the

drip method. One intravenous treatment of this nature was sufficient in 6 patients, 2 in 3 patients, and 4, 5, and 15 respectively in each of 3 patients. Of the patients who died, 2 had single injections of quinine and one had four. With the return of consciousness, routine quinine and atabrin were prescribed orally. The 13 patients who recovered failed to show neurologic abnormalities or any other sequelae of this phase of their illness.

Case report.—The following case is that of a 20-year-old man and is presented as illustrating the more severe type of cerebral symptoms seen in malaria. This was his fifth admission to a hospital because of malignant tertian malaria, each time having been treated with quinine and atabrin. His only complaint was of pain in the upper abdomen. A blood smear showed *P. falciparum* and a course of treatment was started consisting of 30 grains of quinine for 3 days, $4\frac{1}{2}$ grains of atabrin for 7 days, and $\frac{1}{2}$ grain of plasmochin for 5 days. At the completion of this course of therapy, he was free of symptoms except for a low-grade temperature, but a blood smear showed the presence of *P. vivax* and the course of treatment was repeated. He was one of the two patients with a double infection.

In the morning of the second course, he vomited, after which he seemed to be in his usual condition. In the afternoon, while talking to friends he suddenly went into a generalized convulsive seizure followed by a state of coma which persisted for 9 days. During this period, he was given 15 grains of quinine dihydrochloride in 1,000 cc. of 5-percent dextrose solution by the drip method. On the first day he was in a critical condition and required pharyngeal suction. A lumbar puncture yielded clear spinal fluid under increased pressure.

For two days severe convulsions with marked opisthotonos occurred almost continuously and the next day they came every half hour. On the fourth and fifth days the convulsions were hourly, and on the sixth and seventh days they occurred every two hours after which they disappeared and the comatose state which had been broken by transient periods of semiconsciousness gradually was lifted. He was given 30 grains of quinine by mouth for 10 days. Improvement progressed rapidly with restoration of all his faculties and no demonstrable neurologic abnormalities. He was evacuated to the United States 50 days after his admission to the hospital.

Of the three fatal cases, one was admitted with the diagnosis of acute infectious jaundice. He had had fever, chills, nausea, and vomiting for 2 weeks and had a slight icterus. On his second hospital day, he suddenly had a chill and a severe generalized convulsion from which he recovered in an hour. At the end of the second hour he had a second convulsion from which he failed to recover, death occurring during the slow injection of 15 grains of quinine dihydrochloride in 1,000 cc. of 5-percent dextrose solution and of which he had received only a few cubic centimeters. At autopsy, superficial blood vessels of the brain were injected but there was no pigmentation or evidence of thrombosis. Fatty changes were noted in the liver and cloudy swelling of the kidneys.

The second patient was admitted in a comatose condition several hours after a generalized convulsion. An inconstant lateral nystagmus was present and all reflexes were hyperactive. A blood smear showed *P. vivax* and the patient was given 7½ grains of quinine dihydrochloride intravenously without benefit. After a series of recurrent convulsions he expired on the day after admission.

Spinal puncture revealed a normal fluid under diminished pressure. At postmortem examination the spleen was found to be three times its normal size and of soft consistency. The liver was enlarged and showed an advanced degree of cloudy swelling but no microscopic evidence of necrosis or hemorrhage. All tissues were slightly yellow and pale but did not have the appearance of jaundice. The kidneys showed cloudy swelling. The brain was heavier than normal but there was no obvious edema or pigmentation present. There was no microscopic evidence of thrombosis or perivascular extravasation of blood.

The third fatal case was that of a man admitted in a comatose condition with the diagnosis of malaria, benign tertian, a smear positive for *P. vivax* having been obtained before transfer. He had been ill with jaundice for several days prior to the onset of the coma. He was extremely restless and uncontrolled by paraldehyde. Except for hyperactive reflexes, the neurologic examination including spinal fluid obtained under slightly increased pressure was negative. He expired 27 hours after admission and after receiving 62 grains of quinine dihydrochloride in 5-percent dextrose solution intravenously. In the 4 hours preceding death, jaundice increased to an extreme degree. At autopsy a small liver was found weighing 28 ounces and with a mushy consistency. Microscopic examination revealed massive destruction of the liver substance. Cloudy swelling was found in the kidneys. The brain was injected and edematous but neither pigmentation nor thrombosis was seen.

In the treatment of this type of case of malaria with cerebral symptoms, the intravenous administration of a quinine derivative was demanded by the condition of the patient.

Fortunately evidences of true toxic reactions to quinine have been rare and invariably confined to tinnitus and urticaria. It is sometimes difficult to attribute definitely the latter reaction to the drug because occasionally such skin manifestations occur in patients one or two hours prior to a chill and before any treatment has been administered. It is not known whether this state of allergy is associated with an altered form of hemoglobin or due to the properties of the plasmodium liberated by the rupture of the red corpuscles. Vomiting in almost every instance has been due

to the malaria rather than to the drug, and treatment of the disease, often with the valuable aid of intramuscular injections of atabrin, has eliminated the condition. The patients comprising the subject of this paper were in a critical state and required a form of therapy other than the usual oral method.

That overenthusiasm for intravenous therapy may not minimize the possibilities of quinine sensitivity, the following dramatic case is cited.

Case report.—A 25-year-old Marine was admitted in a semicomatose condition. Earlier in the day he had had a severe chill and high temperature followed by a state of mental confusion and unconsciousness. When in the islands, he had had regular prophylactic treatment with atabrin. Three previous attacks of malaria were recorded and information later made available indicated that on two previous occasions sensitivity to the oral administration of quinine caused urticaria, angioneurotic edema, and unconsciousness. At the time of admission, his condition was serious and a blood smear made immediately showed many *P. vivax*. An intravenous clysis of 15 grains of quinine dihydrochloride in 1,000 cc. of normal saline solution was started slowly. In about 20 minutes, after 200 cc. containing approximately 3 grains of the drug had entered the vein, the patient suddenly went into shock, was cold, pulseless, perspired freely, and the heart sounds were inaudible. The breathing was clear but rapid. In 2 minutes spasmodic cardiac contractions could be heard occurring about once every 10 seconds.

One cubic centimeter of epinephrine (1:1,000) was injected via the intravenous needle, and within a minute heart sounds could be heard at a rate of 170. In 15 minutes a feeble pulse was discernible, the blood pressure was 65/30 with marked pulsus alternans. A prominent gallop rhythm was present at the apex of the heart. An electrocardiogram showed paroxysmal auricular tachycardia at a rate of 200, with right axis deviation. Nasal oxygen was administered and in 30 minutes he regained consciousness. The pulse was 120, the blood pressure 90/55, and the patient progressively improved. An electrocardiogram made the following day was normal. After 2 weeks of treatment with $4\frac{1}{2}$ grains of atabrin daily and 5 days of $\frac{1}{8}$ grain of plasmochin daily, a blood smear was negative for malarial parasites. This patient was required to take a prophylactic dose of three atabrin pills weekly during his return trip to the States.

It is our impression that this man suffered from complete heart block and ventricular fibrillation due to quinine sensitivity. A normal cardiac rhythm was eventually reestablished only after prompt administration of epinephrine, and a fatality was consequently avoided.

SUMMARY

Sixteen cases have been reported in which the predominating symptom of benign tertian malaria was coma, and in addition half the patients had convulsions. With the exception of three, all of the patients with cerebral symptoms of malaria recovered without

demonstrable residuals at postmortem examination which also disclosed that two of the three fatalities were icteric. The brain failed to show pigmentation and capillary thromboses, lesions typical of cerebral malaria. The kidneys had cloudy swelling in each case and the liver in one showed fatty changes; another was enlarged and cloudy swelling was marked; in the third case there was a small liver with considerable destruction of the substance.

Patients with cerebral symptoms of malaria demand immediate therapy, and the slow intravenous administration of $7\frac{1}{2}$ or 15 grains of quinine dihydrochloride in 1,000 cc. of 5-percent dextrose solution has been found effective. One instance in which there was a near fatal termination due to heart block following the intravenous injection of a small amount of quinine dihydrochloride, is presented in order to emphasize the extreme caution necessary in this method of treatment. It should be reserved for only critically ill patients.



BLADDER INSTILLATIONS OF COD LIVER OIL

It has been known for some time that fats have a high antiseptic power which is directly proportional with their content of unsaturated fatty acids. Since cod liver oil is composed largely of fatty acids it is an unusually effective antiseptic. A decade ago, the bactericidal effect of cod liver oil on staphylococcus, streptococcus, *Bacillus coli* and the tubercle bacillus was demonstrated. The first three organisms were entirely destroyed in four days, while the last took somewhat longer.

The success is due not only to the antiseptic properties of the oil but also to its stimulating effect on granulation and epithelization, resulting in a remarkable regeneration of all sorts of tissue defects. The observations were made on the treatment of skin burns, and possibly the same pertains in the bladder. It is hypothesized that the oil permeates the necrotic tissue and demarcates it from the healthy tissue. Thereupon the former sloughs and the fresh tissue epithelizes rapidly.

A study made of 25 selected cases of urinary bladder disorders treated by cod liver oil instillations confirmed the alleged analgesic bactericidal and epitheliogenic properties of the oil. The results obtained in the treatment of leukoplakia of the bladder were so encouraging as to prompt this preliminary report in the hope of stimulating further trial by others. The results further warrant its use as an adjunct in the symptomatic management of tuberculous cystitis and in bladders with delayed healing after cauterizing procedures.—EWERT, E. E., and HOFFMAN, H. A.: Use of cod liver oil in urinary bladder. *Lahey Clin. Bull.* 4: 27-30, July 1944.

HIPPURIC ACID LIVER FUNCTION TEST IN RELATION TO MALARIA¹ AND ATABRIN

JAMES K. McCORKLE
Lieutenant (MC) U.S.N.R.

Atabrin has now been in general use for about ten years, and there has been little evidence of toxic action when the drug is given to healthy young Europeans. However, the occasional assumption of hepatotoxic action of the drug still persists. This has been manifested by the reluctance of newly arrived medical officers to employ large doses of atabrin. This cautious outlook is usually changed after observing large groups taking atabrin in both suppressive and intensive dosages. Such conservatism is perhaps due in large part to the physician's unfamiliarity with the drug, as malaria has not been a problem of much importance in a greater part of the United States.

In the attempt objectively to ascertain possible toxic qualities of atabrin, it was decided to perform liver function tests on a group of selected patients in whom there was the greatest likelihood of liver damage. The patients selected were those who had had the greatest amount of suppressive and intensive atabrin therapy and who also presented the most severe clinical picture.

The patients observed were members of troops which had returned from a highly malarious area in the Southwest Pacific to an area free from malaria. In the former area quinine had been used as suppressive therapy until their departure. Atabrin was then substituted and had been used for a minimum period of 4 months prior to the time that the men were seen at this activity.

Various units of this group were observed over a period of 3 months. A large number of men were on atabrin suppressive treatment, and of these a total of 1,346 malaria patients were observed. Approximately 50 percent of these were hospitalized in the field at an adjoining clearing company. Close cooperation was maintained between the two groups, and all patients with symptoms and signs more severe than usual were hospitalized at the Naval activity. This group consisted of 667 patients.

The hippuric acid test was done in the manner described by

¹ Benign tertian.

quick; that is, 6 gm. of sodium benzoate was given orally and the 4-hour urine yield was obtained. The equivalent of less than 3 gm. return of sodium benzoate was considered abnormal. The test is subject to the same criticisms of all liver function tests, but may be considered the best of the rather questionable lot. Fortunately it is simple; even with the minimal facilities available at our activity, it was easy to perform. The literature pertaining to liver function tests in relation to atabrin and malaria has been unobtainable here, and no doubt other studies of larger scope have been made.

Fifty-five cases were selected for testing. This group may seem small in view of the large number admitted; however it was learned that only a minority of those admitted had actually taken the constant dosage of 0.6 gm. of atabrin weekly despite general orders to do so. The hippuric acid test was done on those with the most pronounced clinical picture as manifested by prolonged fever, delirium, nausea, vomiting and diarrhea.

All the members of this group had had a minimum of 4 months' constant atabrin therapy at the rate of 0.6 gm. weekly; 17 of them had stopped taking atabrin 2 to 4 weeks prior to admission. All 55 patients had been in a rest camp and had had one complete course of quinine, atabrin and plasmochin, whether or not they had malaria at the time. With two exceptions all had had two or more intensive courses of atabrin (0.3 gm. daily for at least 5 days). Seventy-nine percent, or 43 patients, had been hospitalized 4 or more times for relapses, thereby entailing a similar number of intensive atabrin courses. It is noted therefore that the majority of these cases were chronic relapses. All cases were proved microscopically to be benign tertian malaria.

During hospitalization here the routine therapy consisted of 2 gm. daily of quinine sulfate for 3 days and 0.3 gm. daily of atabrin for 5 days, followed by 0.1 gm. of atabrin daily for 6 days of each week for an indefinite period. The test was usually run on the second or third atabrin day. Of the 55 subjects tested, 8 showed an initial return of less than 3 gm. of sodium benzoate. It was noted on admission that 5 of the latter group showed slightly icteric sclerae.

Because of bed shortage and necessary transfer, two of these eight patients could not be followed for more than a few days. As one of the two was obviously jaundiced and had had severe chills and fever daily for the 5 days prior to admission, a repeat test was not done. The other patient was not clinically jaundiced and a repeat test 4 days following the first one gave essentially the same result, the equivalent of 2.6 gm. of sodium benzoate. With

the remaining 6 of this low group the normal yield on repeated tests was obtained by the twelfth day of treatment.

It would seem probable that the cause of the lowered liver tolerance was the acute episode of malaria itself, since normalcy was regained within a relatively few days, with the patient meanwhile taking large doses of atabrin. A possible exception was the one non-icteric patient who could not be followed. A slight degree of icterus often observed in the sclerae of these and other patients usually cleared up by the seventh day of treatment.

All cases of icterus observed were transient, except for the one case mentioned above which could not be followed. In this case the jaundice had appeared shortly after the onset of chills and fever. The skin pigmentation of atabrin is easily confused with jaundice. Coloration of the sclera is the only reliable point of differentiation as atabrin has no effect on the sclera.

SUMMARY AND CONCLUSIONS

1. A group of 1,346 malaria patients was observed. The hippuric acid liver function test was done on 55 selected patients. Selection was based on the clinical severity of the disease and the maximal atabrin intake. All patients had had at least 4 months of 0.6 gm. of atabrin weekly. Seventy-nine percent had had at least 4 intensive courses of atabrin, indicating chronic relapses.

2. Eight of these 55 patients had an initially low yield. With the two exceptions, who could not be followed, this group regained a normal yield within 12 days of hospitalization under treatment with quinine and atabrin in large dosages.

3. It may be concluded that the hepatotoxic action of atabrin as measured by the hippuric acid liver function test is insignificant.

4. In the group of patients observed who actually had acute episodes of malaria, and of those others who were on routine suppressive therapy, there were no individuals who were unable to take atabrin. In this group there is no indication that a weekly dosage of atabrin exceeding 0.6 gm. per week would have harmful effect.

In the year that has elapsed since this paper was written the routine dosage of atabrin for symptomatic malaria has been greatly increased. The organization studied in this paper, has been using a suppressive dosage of 0.5 gm. of atabrin twice weekly while in hyperendemic areas and under combat conditions. Observation of patients on this increased atabrin regime has shown no increased clinical evidence of liver damage. Certainly this newer regime has resulted in fewer cases of clinical malaria breaking through the atabrin barrier and probably has lessened the relapse rate.

ACUTE INFECTIVE JAUNDICE AND ACUTE HEPATITIS

360 CASES AT AN ADVANCE BASE

MAYNARD I. COHEN
Lieutenant (MC) U.S.N.R.

A brief discussion of this illness is of interest because there is a high incidence in certain military groups and because it is a prolonged and disabling disease. Epidemics of jaundice occur at infrequent intervals in the civilian population in both urban and rural communities. However, epidemic jaundice has been known to occur among all forces in war, and during the present conflict epidemics in the British and German forces have been reported. Some 2,500 cases were observed during the battle of Crete. Three hundred sixty patients with the diagnoses of acute infective jaundice or acute hepatitis were treated at this hospital in 1943.

Epidemic and sporadic cases of catarrhal jaundice are frequently reported in civilian life. Other outbreaks of jaundice, particularly those occurring in wartime, have been suspected or proved cases of Weil's disease.

Recent studies strongly indicate that the cause of acute infective jaundice and acute hepatitis is a virus. In 1943 Findlay demonstrated that nasal washings from 4 donors ill in the pre-icteric stage of postvaccinial hepatitis produced a similar disease when instilled into the nares of 4 healthy recipients. This finding suggests transmission by direct contact and droplet infection. It has been pointed out that, like yellow fever, it confers a lasting immunity; like rabies it has a long incubation period; and like influenza it produces a leukopenia. All of these characteristics are suggestive of a virus as the etiologic agent.

German investigators (1) in the same year reported the recovery of a filtrable agent resembling a filtrable virus from the duodenal fluid of patients with epidemic hepatitis.

The incubation period is 20 to 40 days, usually 28 days. Infectivity probably occurs only during the pre-icteric stage. Everyone is presumably susceptible. Obviously many escape infection, perhaps because of a childhood-acquired immunity. The 360 patients admitted to this hospital were predominantly from certain Marine Corps regiments. The rise in rate following a military campaign indicates that adverse physical conditions and exposure to infected

personnel played a role in the increased spread of the disease. Recently 11 members of a crew of 65 on one ship developed symptoms of an acute febrile illness. Of this number 7 were admitted to this hospital with jaundice which had become evident simultaneously in all. The only case of jaundice that has occurred among the hospital staff personnel was in an individual who had recently visited a Marine Corps unit from which many of the patients came.

EPIDEMIOLOGY

A thorough epidemiologic study has been made in one military unit which leaves no doubt as to the highly communicable nature of the disease among concentrations of men.

The low mortality rate of acute hepatitis has prevented extensive pathologic study. Aspiration biopsies (2) in the study of the pathologic lesions of epidemic hepatitis and the hepatitides occurring during arsenotherapy and following inoculations of human serum, revealed no histologic differences. The histopathologic picture was one of hepatic cell necrosis and autolysis, associated with leukocytic reaction and infiltration. The centers of the lobules show the first changes, and the portal tracts the greatest cellular infiltration.

In the fatal cases of hepatitis observed during the outbreak of jaundice in the Army (3) the chief pathologic lesions were those of an acute or subacute yellow or red atrophy of the liver. The earliest lesions consisted of frank necrosis of liver cells in the central portions of the lobules.

There have been no deaths among the patients admitted to this hospital with jaundice. The report of the pathologist¹ on histologic sections submitted for study from another Naval medical activity are of interest. A 21-year-old man complained of diarrhea and cramps of 3 days' duration. The findings were suggestive of acute appendicitis. A laparotomy was performed and the patient died during the operative procedure. Necropsy revealed a markedly enlarged hemorrhagic liver and an enlarged spleen. Microscopic examination revealed liver injury involving all parts of the liver lobule, more marked in the peripheral zones. There was cloudy swelling, followed by degeneration of the cords, with changes characteristic of yellow atrophy. Review of the clinical history and pathologic report, together with the known exposure of this individual, suggests acute hepatitis.

The development of symptoms among these patients follows a

¹ Personal communication from Lieutenant A. P. Gewanter (MC) U.S.N.R.

very similar pattern. There is a gradual onset of generalized malaise, weakness, nausea and vomiting, with epigastric or right upper abdominal distress. Diarrhea followed by constipation is common. Loss of appetite is characteristic. The temperature rises to from 100° to 104° F. for 1 to 4 days, and the fever is frequently preceded by a chill. During this period there is a wide variation in symptoms; a small percentage of patients are severely ill. Weight loss may be marked, and the severely ill patients are prostrated and mentally clouded. Usually between the first and fifth days of symptoms, occasionally not until the fourteenth day, the patients note that the urine turns dark in color, and a yellowish tint to the sclerae and skin is observed. Headache is commonly severe, and in one patient meningeal irritation was sufficiently pronounced to necessitate a lumbar puncture.

Most of the patients seen here have been ill for from 1 to 2 weeks. Their appearance is characteristic. There is a striking greenish yellow hue to the sclerae, mucous membrane of the tongue, and skin. They have obviously lost weight, and in nearly every instance there is tenderness over the liver. The spleen is rarely palpable or tender, but in two-thirds of the cases the liver is palpable 1 to 3 cm. below the costal margin in the right mid-clavicular line. In a small group of cases there is slowing of the pulse to 40 to 60 beats per minute, and in these individuals weakness is marked. Pruritus occurs occasionally. There has been no evidence of a hemorrhagic diathesis.

There is a diagnostic problem, however, in the pre-icteric stage of acute hepatitis, when one is faced with an acutely ill, febrile patient with minimal or no positive physical findings. In these cases the diagnosis is made presumptively with the early appearance of hepatic tenderness and the eventual development of characteristic manifestations.

It is reported from the experiences of the British Middle East Forces that acute hepatitis may or may not be followed by jaundice. Accordingly in an epidemic those individuals who do not develop jaundice may be overlooked. Among the patients under treatment at this hospital only one is considered to have had all of the signs and symptoms of acute hepatitis without jaundice.

DIFFERENTIAL DIAGNOSIS

The diseases to consider in the differential diagnosis will fall into two groups to correspond with the pre-icteric and icteric stages. Dengue fever is an acute infectious disease characterized by a saddle-back febrile course, transient rash, leukopenia, and

bony aching. It occurs in epidemic proportions on certain islands in the South Pacific. It is a self-limited disease, in which gastrointestinal symptoms are not pronounced. The early symptoms of nausea, vomiting, diarrhea, and fever in varying degrees would suggest dysentery or acute gastro-enteritis. Appendicitis, in an era in which everyone is appendicitis-conscious, is frequently suspected.

The gastro-intestinal symptoms in acute hepatitis are predominantly diffuse or upper abdominal in location. The daily rise in temperature to 102° to 104° F. in several cases has led to numerous blood cultures in the search for a blood stream infection. Meningitis was considered in one instance.

In the icteric stage of acute hepatitis, malaria is differentiated by a tertian or quartan febrile course, a history of previous attacks of malaria, and enlargement of both liver and spleen. The plasmodium is easily detected on blood smear examination. Obstructive lesions of the biliary tract usually occur in the age group over thirty. Acute hepatitis is a communicable disease of the younger age groups.

Yellow fever is quite similar and varies widely in its symptomatology. It is characterized by proteinuria and a hemorrhagic tendency. Military personnel are protected by routine yellow fever vaccination. Weil's disease is associated with nephritis, severe muscular pain, conjunctival hemorrhages and herpes labialis. The *Leptospira icterohaemorrhagiae* can be recovered from the blood and urine.

LABORATORY FINDINGS

Laboratory findings are as follows. The icteric index ranges from 15 to 120 units, with an average of 45 units. This test is of diagnostic value in suspected cases and acts as a guide to the course of improvement in known cases. The van den Bergh test gives a biphasic reaction. The hemoglobin content and erythrocyte count are in the normal range, with leukocyte count slightly elevated; the differential count is in the normal range. The blood Kahn is negative. The urine examination reveals the presence of bile, but is normal in other respects. Frequent darkfield examinations for the *Leptospira icterohaemorrhagiae* have been negative. The sedimentation rate has been normal or elevated to 15 mm. in 1 hour. Bile is present in the stool.

These patients usually recover in four to eight weeks. Of this series, about one-half have been evacuated for further convalescence after a brief period of hospitalization, and the remainder returned to duty after an average stay of 21 days. During this

time there is continuous improvement. With the subsidence of fever, there is a feeling of well-being, the appetite improves, and the jaundice disappears. The hepatic tenderness diminishes rapidly and there is a favorable weight gain, so that these patients are anxious to return to duty before they have completely recovered. Thus far two patients have had an exacerbation of their illness, 2 and 4 weeks following their symptomatic improvement, with recurrence of hepatic enlargement and tenderness, loss of appetite, and jaundice.

It is generally considered that the ultimate prognosis is complete recovery, and there is no reason to doubt this opinion at present. However, for at least 4 to 8 weeks these individuals are militarily ineffectual. It is frequently stated that cirrhosis of the liver occurs more frequently among individuals who have had epidemic jaundice than in the general population, so that the future health of these patients will only be known after extended observation.

There is no specific treatment. Parenteral fluids are indicated in the presence of dehydration. Rest in bed is most important, as well as a diet high in carbohydrate and protein and low in fat, with supplementary vitamins.

REFERENCES

1. SEIDE, W., and LUZ, K.: Zur ätiologie der Hepatitis epidemica. Klin. Wchnschr. 22: 70-74, January 23, 1943.
2. DIBLE, J. H.; McMICHAEL, J.; and SHERLOCK, S. P. V.: Pathology of acute hepatitis; aspiration biopsy studies of epidemic, arsenotherapy and serum jaundice. Lancet 2: 402-408, October 2, 1943.
3. Medicine and the War. Outbreak of jaundice in the Army. J.A.M.A. 120: 51-53, September 5, 1942.



PHTHALYLSULFATHIAZOLE ON CLOSTRIDIA

The vegetative forms of the clostridia are greatly reduced following the oral administration of phthalylsulfathiazole, and stools are rendered essentially odorless without ordinarily producing a diarrhea. The drug is shown, likewise, to be an effective bacteriostatic agent locally in the bowel as is indicated by the alteration of the coliform bacteria in the presence of a watery diarrhea.

As indicated by the alteration of the coliform flora in the bowel of man, phthalylsulfathiazole, *in half the dosage*, is as effective as succinylsulfathiazole.—POTH, E. J., and ROSS, C. A.: Clinical use of phthalylsulfathiazole. J. Lab. & Clin. Med. 29: 785-808, August 1944.

OBSERVATIONS ON MALARIA

DANA A. WEEKS
Lieutenant (MC) U.S.N.R.

During an eight-month period as tropical disease officer of a continental hospital, opportunity was afforded to observe a considerable number of malarial patients. These were evacuated personnel sent back to a training center in the States from a Southwest Pacific battle zone. Many of them were evacuated because of the severity of their malaria, whereas others were assigned for the purpose of undertaking a more advanced technical study or to serve as instructors.

With the exception of five, all the persons constituting the subject of this paper had had more than one remission. The five patients referred to experienced their first paroxysm of malaria 5 months after leaving the malarial zone and 4 months after their last suppressive therapy. Of the 725 cases observed, the average number of malarial remissions before hospitalization here was 6.6, which shows the resistant character of the infection. Twenty percent of these patients had suffered 10 or more attacks during as many months and 5.7 percent had had 15 or more attacks.

There are two factors explaining the resistant nature of the malaria in this series. First, these patients contracted malaria under battle conditions, when physical and mental fatigue was great and opportunity for treatment limited. Second, the predominant type of malaria found in this series was caused by *Plasmodium vivax*, which is more resistant to therapy, more prone to remissions, and slow to establish antibody response in the victim. Inasmuch as a limited number of men were evacuated to this country, the more resistant cases and those patients in the poorest physical condition make up this series.

The 725 cases accounted for 909 admissions to this hospital during the eight months of the study. During the last 4 months of the study the complement of evacuated troops in the area was practically static and the admission rate dropped markedly. The predominating type of organism seen was *P. vivax*. Ten cases recorded *P. malariae* and 4 were *P. falciparum*. Positive thick smears were obtained in all except 10 percent and in these cases self medication had already been started. Only about 60 percent of the smears were diagnosed for type because of the routine thick

smear technic; thin smears to establish questionable type were only done as time permitted. Although a large number of cases of falciparum malaria were reported in the battle zone, the organism *P. falciparum* is considered more amenable to antimalarials and does not have the tendency of *P. vivax* to cause remissions. This circumstance, inasmuch as this series consists mostly of chronic cases, accounts for the predominance of the *P. vivax* organism.

The purpose of this paper is primarily to present some observations on conditions which, due to their marked severity or frequency, become major problems in the handling of malarious patients in large numbers. They are discussed under the following topics: (1) Thyroid-like syndrome, (2) anemia, (3) loss of weight, (4) icterus, its relationship to atabrin and the course of the disease, and (5) period of therapy.

Thyroid-like syndrome.—Ten patients presented a syndrome which so closely simulated thyrotoxicosis that basal metabolic rates were done on all this group. These patients showed prominence of the eyes and widened orbital fissures. Lid lag, however, was absent. All of them had marked loss of weight, sudoresis, wet palms, rapid pulse, extreme nervousness with lack of concentration, and a fine tremor of hands and tongue. Because of these physical signs and symptoms, the basal metabolic rates were carefully taken and checked in each instance. The results ranged from -20 to $+10$.

Examination by a psychiatrist eliminated "war neurosis" as a causative factor. Since improvement under treatment with anti-malarials and rest was slow in all these cases, it is probable that other factors complicated the malaria.

Loss of weight.—This was a prominent feature of the malarial admissions, nearly all the patients showing it to some degree. The average patient was 16.5 pounds under his normal weight despite hospitalization on 4 or 5 occasions, 60 days in rest camps, and a 30-day furlough after returning to this country. Sixteen percent were 30 or more pounds under weight. Concurrent hookworm disease was present in only 10 patients of the series and consequently was of minor importance in the weight loss.

Anemia.—Anemia was a persistent finding in this series. The average erythrocyte count was 4,270,000. Thirty-one percent had red blood cell counts below 4,000,000 and $7\frac{1}{2}$ percent were below 3,500,000. Those patients having below the average of 4,270,000 red cell count complained of symptoms referable to anemia, i.e., fatigability, lack of energy, and general asthenia. The average hemoglobin was 89.7 percent with a color index of 1.05.

Gastric symptoms.—Gastric and abdominal symptoms were

present in one-third of the patients during the acute phase of their illness. In many of these they dominated the prodromes, and persisted long after apparent recovery. Cramp-like, sharp epigastric pain preceded the paroxysm by several days and was often tertian in periodicity. These symptoms, with nausea and vomiting so simulated the "acute abdomen" that 11 patients were transferred to this hospital under surgical diagnoses. However none were subjected to surgery.

In a small group, gastric symptoms were so severe as to necessitate parenteral administration of antimalarials to control the disease, and the intravenous use of saline and dextrose to control the dehydration. In all cases needing parenteral administration of antimalarials, 0.3 gm. atabrin intramuscularly was given. This was done at 6-hour intervals and in every case three doses were effective without any untoward symptoms.

A group of patients constituting one-third of the dyspeptic patients, or 10 percent of the series, was afflicted with persistent chronic gastric disturbances, characterized by vague cramp-like pains across the upper abdomen, occurring without relationship to food. Even when entirely recovered from a malaria relapse, and for many days following, these patients had vomiting after meals with or without distress and nausea. The consumption of only small amounts of food satisfies what the patient terms a normal desire for food, and the consumption of any more food leads to this mechanical vomiting. In some patients this dyspepsia was part of the prodromes and started weeks before the paroxysm.

This abdominal pain and nausea was not relieved as well as was expected by the use of amphoteric salts and antispasmodics. Frequently during the acute phase of a recrudescence, $\frac{1}{4}$ grain morphine sulfate was used and found efficient in controlling the vomiting until antimalarials took effect.

Twenty-eight patients having the more pronounced chronic stomach complaints were studied by analysis of gastric acidity. Fasting specimens, and 1- and 2-hour specimens after a test meal of dry toast and clear tea or water were analyzed for free and total acid. Eight of the 28 cases showed almost a true achlorhydria and only 1 an excess of acid. Nine cases were definitely below the normal acidity and 10 were in the normal range.

It followed that nearly all cases of chronic dyspepsia treated with dilute hydrochloric acid were greatly benefited. The dose was usually 10 to 15 minims in water before meals, although many experienced greatest relief by taking the drug directly after eating. It eliminated the need of antispasmodics. The clinical relief of the symptoms was even more marked than the gastric analysis

indicated. Moreover the therapy was readily acceptable to the patient. In addition the use of dilute hydrochloric greatly aids the solution of quinine which is so often given in compressed tablet or powder form.

Atabrin and jaundice.—Although jaundice is not a frequent finding in malaria, more than one-third of the patients showed a saffron hue to the skin which was generally interpreted as jaundice, although the sclerae are usually spared. The coloration is due to the aniline dye constituent of atabrin, and since it preceded many malaria attacks, and because practically all the patients had received atabrin both for suppressive and therapeutic purposes, and because of the fact that malaria itself produces jaundice by hemolysis of red blood cells, the following steps were taken to investigate the nature of the icterus.

First the serum icterus index was used to determine the degree of pigmentation before and after a 30-day course of therapy with 0.3 gm. atabrin daily. Graph 2 shows the range and number of cases for each degree of jaundice before and after treatment. Although one-third of the cases had clinically demonstrable jaundice, only 9 percent had a high enough icterus index to cause clinical jaundice.

The effect of treatment with atabrin was to bring the icterus index within normal range. Moreover after treatment with atabrin all increased icterus indices were lowered and none remained high enough to produce clinical jaundice. Only 5 percent read over ten.

Investigation using the van den Bergh reaction.—Since the results from icterus index determinations indicated that there was a color substance staining the blood serum, further investigation as to its nature was done, using the van den Bergh reaction. As in the use of the icterus index, van den Bergh reactions were taken before and after the same course of therapy. The results of the 210 cases studied showed that none had a direct positive van den Bergh in less than 10 minutes although most cases having an icterus index over 10 had an increased indirect van den Bergh. All cases having a positive indirect van den Bergh (greater than 0.3) had an icterus index greater than 10, and 43 cases, 21 percent, had increased bilirubin in the blood serum as indicated by the van den Bergh reaction.

The results of the van den Bergh reaction substantiated, and were concurrent with the findings suggested by the icterus index and furthermore showed that the increased icterus index was due to hemoglobin breakdown products. Those cases having increased icterus index invariably had increased indirect van den Berghs, and therefore for practical purposes the icterus index may be used

with accuracy in investigation of jaundice in cases of malaria, even though the patients are treated with atabrin.

The effect of treatment with atabrin in the above series was to return the van den Bergh to normal in all but 5 cases. Of these 5, one responded after further intensive treatment; 2 still had positive smears for malaria; and 2 were discharged from the hospital and readmitted within 10 days with clinical malaria.

Experience with antimalarial therapy.—There are two distinct schools of thought concerning antimalarial therapy, one favoring a long term of at least 30 days of treatment and the other a shorter course of 7 to 10 days. Both regimens were used at this hospital but due to frequent transfer of men and inadequate facilities for follow up, no positive conclusions in this regard could be drawn. During June, July, and August, a short course of 10 days was used and during August, September, October, and November, a 30-day course was employed.

Routine followed during malarial therapy

Ten-day course of antimalarial therapy

Days	Drugs	Dose (grains)	Time	Laboratory procedure
1-3	Quinine	10	Thrice daily	Smears
4-7	Atabrin	1½	after meals	
*8-10	Atabrin	1½	do	Smears
	Plasmochin	½	do	

* Discontinued because of toxicity.

Thirty-day course of antimalarial therapy

Days	Drugs	Dose (grains)	Time	Laboratory procedure
1-2	Quinine	15	Thrice daily	3 smears, complete blood count, icterus index and van den Bergh test.
3-5	Quinine	10	do	
6-15	Atabrin	1½	do	
16-20	Atabrin	1½	do	
21-30	Atabrin	1½	do	3 smears and van den Bergh test.

The following observations, however limited, were noted concerning the short course of therapy: (1) In many cases the condition of the patient at the end of treatment did not warrant discharge to duty, (2) many patients had positive smears at the end of 10 days' treatment, and (3) the success of a short course of treatment depends on discharging patients with continuance of

suppressive therapy. It was found that enlisted personnel could not be depended on to take suppressive treatment or to use discretion during this period. Consequently recurrence of malarial attacks within a few days was common.

These weaknesses in a short course of therapy cannot, however, be considered sufficient criticism to detract from its usefulness in the war zone where time and manpower are all-important. With time and facilities permitting, it was considered that a long period of therapy was best suited to this group of patients for the following reasons: (1) They were chiefly patients with chronic disease, who had not regained normal standards of health, (2) they were in need of regimented rest and recreation, and (3) they were in need of regimented medication to insure taking of the medication.

Since chilling, extensive exercise on hot days, fatigue and exposure produce parasitemic responses, a long course of therapy provides occasions for supervising the administration of medication and for regimenting programs of work, exercise and sports at a time when the blood level of antimalarial medication is at a therapeutic degree.

Plasmochin.—Before plasmochin was discontinued, it had been administered to 270 patients. The dosage was 1/3 grain twice a day for 3 days. Only a few patients experienced untoward symptoms. Five percent had slight nausea and abdominal pains. Three cases developed a chemocyanosis characterized by a slate-blue coloration of the malar areas, the nail beds, and lips. There was no apparent shortness of breath nor was the cyanosis relieved by oxygen inhalation. The hemoglobin determination in these cases was normal and all cases recovered spontaneously in 2 to 3 weeks.

One case of hemoglobinuric fever was apparently precipitated by the taking of plasmochin. This patient, a recruit, had contracted malaria in Florida 5 years previously. He was admitted to this hospital with typical chills and fever and treated according to the 10-day course. Recovery from the acute stage was excellent but on the second day of plasmochin he developed pains in the loins, an increase in temperature to 102° F. and the next morning voided typical dark urine. The course of the disease was that of severe blackwater fever with subsequent recovery. It is felt that plasmochin was the precipitating factor.

SUMMARY

1. The dyspepsia which so often is present in malarial victims is closely associated with a decrease in the free and total hydrochloric acid content of the stomach. This may be organic or neuro-

genic due to neutralization of stomach contents by duodenal juices as a result of antiperistalsis. Empirically and by laboratory tests dilute hydrochloric acid proved useful in treating these symptoms.

2. Anemia is a frequent finding and is of a hyperchromic type.

3. Atabrin has been considered toxic and productive of liver damage. Practically all patients in this series had received atabrin for suppressive therapy for a period of months and on many occasions for treatment of malaria. Further treatment with atabrin did not cause demonstrable liver damage, but on the other hand it cleared from the blood of these patients the only evidence suggestive of a toxic reaction. The fact that it is a dye and stains the skin should not incriminate the drug as a cause of jaundice.

4. The only cases of malaria which had positive indirect van den Bergh reactions at the end of the period of therapy were active cases of malaria. The indirect van den Bergh should be a useful aid in diagnosis of latent malaria and a guide to prognosis when smears remain negative.

5. When time and facilities permit, a long course of antimalarial therapy should be prescribed.



LUGOL'S SOLUTION—THIOURACIL IN TOXIC GOITER

In the first operations upon patients who had had the metabolic rate lowered with thiouracil, the difficulty in controlling bleeding, the ease with which ties cut through the remaining portion of the gland, and the general friability of the gland so that it would not hold double hooks were of such character as to remind one of early operations upon patients with exophthalmic goiter before the iodine era. There is nothing more disturbing than the continuous oozing which comes from the friable, involuted thyroid gland of the patient who has been prepared with thiouracil alone. This is of such extent as to make it almost impossible to control oozing.

When thiouracil patients are given Lugol's solution, their glands become firm, pale and nonfriable and hold the double hooks well. The bleeding is no longer uncontrollable, and one can do a satisfactory anatomic dissection in a dry field almost as satisfactorily as in those patients prepared solely with Lugol's solution. This plan, which is now regularly employed in preparing patients for surgery, seems to combine the advantages of both methods of preparation, thiouracil being used to lower the metabolism and Lugol's solution to involute the gland so as to make it technically easier to operate upon.—LAHEY, F. H.: Combination of Lugol's solution with thiouracil in preoperative preparations of patients with toxic goiter. *Lahey Clin. Bull.* 4: 2-3, July 1944.

PATHOGENIC ENTERIC BACILLI¹

III. THE SHIGELLA GROUP

LAVERNE A. BARNES

Lieutenant Commander H-V(S) U.S.N.R.

Of the various groups of gram-negative bacilli that are of significance in gastro-intestinal disease in man (1) (2), the shigellas are by far the most important from the military standpoint. In fact, bacillary dysentery is one of the major causes of noneffectiveness due to disease among the armed forces (3) (4) (5) (6).

Although dysentery as a clinical entity was recognized at least as early as the hippocratic era, it was not until the close of the nineteenth century that etiologic agents of the bacillary form were described. *Shigella dysenteriae* was the first member of the genus to be proved a cause of dysentery; this was Shiga's bacillus in Japan (1898), and was followed by Flexner's work (1900) in the Philippines on the group bearing his name, the identification of *S. sonnei* in Denmark by Sonne (1915), *S. ambigua* (the Schmitz bacillus) in Romania by Schmitz (1917), *S. alcalescens* (1918) by Andrewes (7), and other so-called *S. paradysenteriae*.

It is remarkable that so little has been accomplished in the control of this important disease in the last 40 years; indeed it appears to have quite as high an incidence in military forces today as it did in World War I (4). The purpose of this article is to present a brief discussion of bacillary dysentery in the light of more recent observations, with the objective of stimulating interest in the identification of the specific causative agents concerned.

Nomenclature.—Because of certain inconsistencies in the biochemical and serologic characteristics among the members of the group, it is not easy to present a satisfactory definition of the genus shigella. In general, however, an organism that is a non-motile, gram-negative, nonspore-forming rod, that fails to produce hydrogen sulfide, does not utilize citrate or liquefy gelatin, does not produce acetylmethylcarbinol or hydrolyze urea, and that ferments glucose without gas formation (with two exceptions), but fails to ferment salicin, may well be suspected of belonging to the shigella group.

¹Part I of this grouping, *Paracolon*, *Proteus* and *Pseudomonas*, appeared in the October BULLETIN. Part II, The *Salmonella* Group, appeared in the November issue.

It should be noted that there are three major points of differentiation between the shigellas and salmonellas. In general the shigellas are nonmotile, do not produce hydrogen sulfide, and fail to form gas; whereas the majority of species of the salmonellas are actively motile, produce large amounts of hydrogen sulfide, and form large amounts of gas in the carbohydrate mediums attacked. The lines of demarcation are not so sharp, unfortunately, between the shigellas and certain anaerogenic species of the paracolon and proteus groups.

The present and justifiable trend in nomenclature is to discard the older terms, *Bacillus dysenteriae*, *Bacillus paradysenteriae*, and the like, for the more correct generic designation of shigella together with the type-specific names (8) (9). Thus, the genus shigella comprises at present 20 species of medical importance that are fairly well differentiated by biochemic and serologic means; in addition, there is a rather heterogeneous group formerly known as *Bacillus dispar* (10) that has not been studied sufficiently to permit a species differentiation. Other members of the genus will be mentioned in a subsequent section.

Infections by members of the genus shigella are now referred to as shigelloses; this is correct terminology because, although the clinical entity previously designated as "dysentery" certainly is an outstanding feature of the disease, its peculiar characteristics, as toxicity, and blood and mucus in the stools, are not always present in shigellosis. Further, these signs are seen frequently in gastro-intestinal disease produced by members of other genera.

The terminology discussed above will obviously preclude the use of such phrases as "true dysentery bacilli" and "paradysentery bacilli," and again rightly so, since the emphasis should be placed upon the specific diagnosis of the infecting type of organism rather than upon the ultimate effect of the pathogens in hosts of varying and uncertain susceptibilities.

Shigella infections in man.—As a disease, shigellosis is, under natural conditions, essentially limited to man, although there are certain exceptions. Spontaneous infections due to shigellas found in man may occur in monkeys and more rarely in dogs; some species of the genus are found in canaries, chickens, and foals (11).

The organisms enter the body through the ingestion of food or drink contaminated by the feces of patients or carriers. The onset is usually sudden, with fever and abdominal cramps followed soon by the passage of loose, yellowish to greenish, watery stools, which

may rapidly change to the characteristic mucopurulent bloody stools. Tenesmus is a prominent symptom; toxemia and dehydration are marked in severe cases. Frequently, the symptoms just cited do not develop, but are limited to a mild or severe diarrhea with relatively little evidence of toxic processes (12). As a rule, the organisms set up a localized infection in the mucosa of the large intestine, and only in rare instances do they invade the blood stream (11) (13). Hyperemia, edema, and diffuse hyperplasia of the lymph nodes occur in the early stages; within a short time the lymph nodes begin to undergo necrosis and hemorrhages ensue (9).

The mortality rate in bacillary dysentery is difficult to determine for various reasons. In view of the fact that many mild cases are unreported and that many severe ones are incompletely reported, statistical analysis is not reliable. Available information has suggested, however, that the gross mortality rate in the United States is approximately 5 percent (11); it may be higher in the tropical and subtropical zones.

In the chronic stage of the infection, intramural, slow-growing abscesses occur and break through the mucosa with spotty or confluent denudations of the inner surface; in the final stage, the intestinal wall may be changed into a thickened, rigid tube consisting mainly of vascularized connective tissue (9). These conditions are likely to render bacteriologic diagnosis difficult; the use of the rectal swab technic (14) is claimed to yield more positive cultures than the usual stool specimen.

Without going into the details of classifying carriers, it should be emphasized that individuals harboring shigellas are responsible for epidemics of bacillary dysentery. The period of the carrier state obviously varies, depending upon the circumstances surrounding the carrier. According to data collected by Neter (11), nearly 3 percent of convalescent carriers may excrete the organisms for more than 3 months after the onset of the disease. In general, carriers of the flexneri types appear to be healthy, whereas those harboring the dysenteriae (Shiga) species tend to show persisting symptoms.

A significant percentage of convalescent carriers may remain potentially dangerous for at least a year following recovery from the acute stage; thus, the carrier rate among well personnel may be higher than is usually recognized. Of considerable importance are the observations that some individuals with no history of the disease may harbor shigellas, and that certain carriers may show evidence of recurrent excretions of the organisms with negative findings in the interims.

BACTERIOLOGIC CHARACTERISTICS

The bacteriologic diagnosis of shigellosis depends upon the isolation of the infecting organism from the contents of the intestinal tract. In sporadic or epidemic cases of acute dysentery, stool cultures will usually yield the causative organisms providing the specimens are obtained early in the course of the disease and are subjected to laboratory examination within a short time after passage. In carrier surveys or in chronic conditions the rectal swab specimen is always to be preferred. As a matter of fact, this method of securing samples has much to recommend it even when investigating epidemics. The materials and methods used are described by Hardy and his coworkers (14).

If the specimen cannot be cultured within 2 hours, a representative sample should be held in a suitable preserving fluid. Several of these have been suggested, one of which is a saline solution buffered at pH 7.4 and containing neutral glycerin in a final concentration of 30 percent; another contains sodium citrate and sodium desoxycholate to suppress the troublesome coliforms (15). Tetrathionate broth as an enrichment medium is favorable for only a small proportion of the shigellas.

The specimen should be cultured on S-S (salmonella-shigella) agar plates to obtain well isolated colonies. On this medium typical colonies vary in size up to about 5 mm. in diameter, are rather flat, colorless, opaque to transparent, and have a slightly irregular margin; not infrequently a slightly darkened center is observed, and occasionally the colonies have a "honey-drop" appearance.

From single, well isolated colonies, surface portions are transferred to infusion or nutrient agar slants and, after growth of a pure culture is obtained, subcultures in carbohydrate and other special-purpose media are made to aid in making preliminary identification. Boyd (16) classified the shigellas upon the basis of their ability to ferment lactose and mannitol; this serves as a useful means of tentative bacteriologic grouping. The biochemic characteristics of 22 shigella strains are shown in table 1.

As may be observed from this table, a fair degree of preliminary differentiation can be made upon the basis of cultural reactions. A test of recent development (17) (18) that has promise as an aid in identification is based upon the ability of certain shigellas to reduce trimethylamine oxide.

Of considerable interest is a group of non-mannitol fermenting strains isolated from cases of dysentery by Sachs (19). These organisms are reported to be widely distributed in India and Egypt and, because of their potential importance in military

TABLE 1.—Genus *shigella* (gram-negative rods; non motile; do not produce H_2S ; do not utilize citrate; do not liquefy gelatin; Voges-Proskauer negative; salicin negative. Biochemic characteristics)

Group	Shigella species	Glucose	Lactose	Sucrose	Mannitol	Xylose	Maltose	Rhamnose	Dulcitol	Arabinose	Sorbitol	Adonitol	Tri-meth. oxide	Indol
I	Dysenteriae.....	A	—	—	—	—	OC.A	A	—	—	—	A	—	+
	Ambigua.....	A	—	—	—	—	—	—	(AG)	—	—	—	—	—
	Flexneri VI (Newc)...	AG	—	—	—	—	—	—	—	—	—	—	—	—
II	Flexneri I.....	A	—	(A)	A	—	(A)	—	—	A	—	—	—	+
	Flexneri II.....	A	—	—	A	—	A	—	—	A	—	—	—	+
	Flexneri III.....	A	—	(A)	A	—	—	V	—	A	A	—	—	+
	Flexneri IV.....	A	—	(A)	A	—	(A)	A	—	—	—	—	—	+
	Flexneri V.....	A	—	(A)	A	—	(A)	—	—	(A)	—	—	—	+
	Flexneri VI (88).....	A	—	—	A	—	(A)	A	(A)	—	—	—	—	—
	Flexneri VI (Manch.)...	AG	—	—	AG	—	—	—	(AG)	—	—	—	—	—
	Flexneri VII.....	A	—	(A)	A	—	A	—	—	A	—	—	—	+
	Flexneri VIII.....	A	—	—	A	—	(A)	—	—	A	(A)	—	—	+
	Flexneri IX.....	A	—	—	A	(A)	(A)	—	—	A	—	—	—	—
	Flexneri X.....	A	—	—	A	—	(A)	—	—	A	—	—	—	—
	Flexneri XI.....	A	—	—	A	(A)	(A)	—	—	A	(A)	—	—	—
	Flexneri XII.....	A	—	—	A	(A)	(A)	—	A	A	A	—	—	—
	Flexneri XIII.....	A	—	—	A	(A)	(A)	—	—	A	A	—	—	+
III	Flexneri XIV.....	A	—	OC.A	A	A	(A)	A	A	A	A	—	+	+
	Alcalescens.....	A	—	—	A	—	—	—	—	—	—	—	—	—
	Sonnei.....	A	(A)	(A)	A	—	—	A	—	—	—	—	+	+
	Ceylonensis.....	A	A	A	A	A	A	A	A	A	A	—	+	+
	Madampensis.....	A	A	A	A	A	—	A	—	—	—	—	+	+

() = Delayed 48 hours or more. O = Usually true. V = Variable.

TABLE 2.—*Sachs' group of shigellas (do not liquefy gelatin; fail to ferment lactose or mannitol)*

Strain number	Biochemic differentiation					
	Glucose	Sucrose	Dulcitol	Arabinose	Indol	Milk
Q 771.....	A	—	—	A	—	A or sl. A
Q 1167.....	A	—	—	—	—	Sl. A
Q 1030.....	A	—	(A)	A	—	A
Q 454.....	A	—	—	A	—	A
A 12.....	AG	—	—	AG* to (A)	—	A
Q 902.....	A	—	Alk.	A	+	(Alk.)
B 105.....	A or AG	(A)	Alk.	—	+	(Alk.)
B 81.....	A	(A)	Alk.	—	+	(Alk.)

* Gas generally absorbed by 7th day. () = delayed 48 hours or more.

forces, their characteristics are shown in table 2.

These types are distinguishable serologically from *S. dysenteriae* and *S. ambigua*. Two of the Sachs' strains, Q 771 and Q 1167, have been encountered in Tunisia by Christensen and Gowen (20) who have proposed the name *S. arabinotarda*. These two species are serologically different and have been designated as type A (Q 771) and type B (Q 1167).

It is only to be expected that newly encountered strains and types of shigellas will be described from time to time; certainly the opportunities are vast and much valuable epidemiologic information should be obtained during the present global war.

The group of shigellas considered together as *Bacillus dispar* (10) have not generally been thought of much importance as disease-producers; as a result relatively little is known about them. Recent observations have, however, established at least four biochemic types within the group (21). It would seem logical to be on the alert for further evidence regarding the significance of these organisms.

Although bacteriophages can be developed that are highly effective against shigellas in vitro, there is little indication of their value from the standpoint of the bacteriologic diagnosis of types, particularly in view of the serologic advances that have recently been made. The presence of an active bacteriophage in stool specimens may possibly account for certain failures to recover the organisms. The addition to the feces of formalin in a final concentration of 1:10,000 to 1:7,500 has been suggested as a means of overcoming this difficulty (22). It is not within the province of this paper to discuss the treatment of bacillary dysentery. In this connection, however, it is of interest to mention the recent observations of Boyd and Portnoy (23) who concluded that "bacteriophage fails to exercise in vivo the potent properties which it exhibits in vitro."

ANTIGENIC COMPOSITION AND SEROLOGIC DIAGNOSIS

The serologic characteristics of the shigellas follow those of other enteric genera in that their behavior depends upon a particular combination of chemical constituents. The nonmotility resulting in the lack of flagellar antigens obviates the necessity of identifying more than the dominating somatic factors. The antigenic complex of the cell is composed mainly of a mixture of carbohydrate, protein, and lipid which, in its natural state or equivalent, constitutes the so-called complete antigen; the carbohydrate portion, which serves as a hapten, determines type-specificity. A brief but excellent discussion of the immunochemistry of the shigellas may be found in Weil's review (9). The complete somatic antigen is poisonous, and presumably is responsible for the characteristic symptoms following infection.

Shigella dysenteriae (the Shiga bacillus) is the only member of the genus known to produce a true soluble exotoxin; the elaboration of this toxin, in addition to the presence of the complete somatic antigen, results in a syndrome discussed by Weil.

The first significant attempt to establish a serologic classification of the shigellas of medical importance was made by Andrewes and Inman (24) in 1919, and dealt with the mannitol-fermenting (Flexner) species. The members of this group were shown to contain at least four antigenic combinations and, upon the basis of predominance of one factor, the strains were labeled as Flexner V, W, X, or Z types. Another organism, called Flexner Y, corresponding to the Hiss-Russel-Y, was believed to contain a rather evenly balanced mixture of the V, W, and Z factors.

The subsequent observations of Boyd (16) (25) extended the group and established a system of serologic classification employing both type-specific and group antigen designations; these strains have been referred to as the Flexner-Boyd types (previously the paradysenteriae group). Boyd's work was largely confirmed by Wheeler (26). Neter (27) listed the relationships of various strains as classified by various authors and suggested Arabic numerals for the type designation of the Flexner-Boyd strains.

As a result of an excellent and extensive study of the entire question of the serologic relationships of the Flexner-Boyd group, Weil and his colleagues (28) have recently advised classification by a method that labels *primary* or *major* antigens. This appears to be a logical approach. They recommend the abandonment of a qualitative distinction between type-specific and group antigens.

This schema recognizes 14 types within the so-called paradysen-

teriae group and suggests that the strains be given the specific name "flexneri" followed by the type number in Roman numerals; such a system has much in its favor and, following observations on a number of cultures, has been adopted by the Enteric Pathogen Laboratory at the Naval Medical School.

At least three types with dual primary antigens have been encountered; this is not inconsistent with the "sub-races" such as the VZ of Andrewes and Inman, and is analogous to the "O" antigen combinations found in the serologic classification of the salmonellas. Type-specific, adsorbed antisera are now available for the serologic identification of 18 shigella types of established pathogenicity. These, and in addition the dispar strains, are listed with present and previous designations in table 3.

TABLE 3.—*Serologic classification of the genus shigella (after Weil, Black, and Farsetta)*

Present name and type	Previous designation
<i>Shigella dysenteriae</i>	Shiga bacillus
S. <i>ambigua</i>	Schmitz bacillus
S. <i>flexneri</i> I.....	S. <i>paradysenteriae</i> "V" (A & I)*
S. <i>flexneri</i> II.....	S. <i>paradysenteriae</i> "W" (A & I)*
S. <i>flexneri</i> III.....	S. <i>paradysenteriae</i> "Z" (A & I)*
S. <i>flexneri</i> IV.....	Boyd type 103
S. <i>flexneri</i> V.....	Boyd type P 119
S. <i>flexneri</i> VI.....	Boyd 88-Newcastle-Manchester group
S. <i>flexneri</i> VII.....	S. <i>paradysenteriae</i> "X" (A & I)*
S. <i>flexneri</i> VIII.....	S. <i>paradysenteriae</i> "Y" (A & I)*
S. <i>flexneri</i> IX.....	Boyd type 170
S. <i>flexneri</i> X.....	Boyd type P 288
S. <i>flexneri</i> XI.....	Boyd type D 1
S. <i>flexneri</i> XII.....	Boyd type D 19
S. <i>flexneri</i> XIII.....	Boyd type P 143
S. <i>flexneri</i> XIV.....	Boyd type P 274
S. <i>alkalescens</i>	B. <i>alkalescens</i>
S. <i>sonnei</i>	Sonne's bacillus
S. <i>ceylonensis</i>	B. <i>dispar</i>
S. <i>madampensis</i>	B. <i>dispar</i>

* A & I refers to Andrewes and Inman.

In any discussion of the serologic diagnosis of infections due to the enteric group, the question invariably arises as to the value of the Widal reaction. Present evidence strongly indicates that such a procedure is of very limited value under most circumstances; in the shigelloses the arguments against the use of the technic are convincing enough to justify a definite recommendation that it never be used.

In general, bacillary dysentery is of relatively short duration and consequently the formation of antibodies is irregular. This is undoubtedly due in part to the transient localization of the organisms in the mucosa without invasion of the bloodstream. It is known that fairly strong agglutinins may occur in individuals having no history of infection with shigellas, hence there is no titer that can be considered diagnostic. The fact that at least 18

suitably prepared and maintained antigens would be required in stock for reasonably complete coverage of types constitutes a serious barrier.

Of even more importance serologically is the overlapping of minor antigens between types, particularly in the flexneri series; thus it was found (28) that there were 18 different "patterns" in which rather marked cross-reactions with unadsorbed sera were observed with one to seven types other than the specific one. It is obvious, therefore, that Widal reactions with any of the flexneri types would be extremely difficult to interpret.

By far the most effective means of serologic diagnosis is through the use of adsorbed, type-specific antiserums for their reactions on pure cultures isolated from fecal specimens. It must be emphasized that neither serologic nor biochemic identification should be made alone. The logical and most satisfactory procedure is to make a preliminary diagnosis from culture characteristics, then attempt confirmation and type identity by suitable sera. Due to the presence of certain salmonella antigens in some of the shigellas (29) and a sharing of antigens between strains of shigellas and coliforms (30), it is unwise to make a serologic diagnosis without having adequate biochemic information at hand.

The sera that are recommended are prepared for use in the slide agglutination technic. It should be mentioned that certain strains of shigellas in the live state may not agglutinate at first observation in their specific serum; this has been explained by assuming the presence of a peculiar, heat-labile "sheath" (28); such strains become readily agglutinable when suspended in physiologic saline solution and heated in a boiling water bath for from 5 to 30 minutes. Inagglutinable races of the following types have been encountered: Ambigua, alkalescens, flexneri VI, flexneri X, and flexneri XIII.

DISTRIBUTION OF SHIGELLA TYPES

Data on the incidence and distribution of shigella types are at present of little statistical significance; this is due in large measure to the fact that, although it has not been difficult to differentiate bacillary dysentery from other diarrheal diseases, precise methods for type identification of the causative organisms have not been available. Serologic diagnosis has now reached the stage where it is possible to obtain more exact information, and it is to be hoped that full use will be made of the opportunities. A well organized program directed toward determination of the distribution of shigella types would be of extreme value in connection with

present projects for the development of prophylactic inoculations.

Shigellosis is of world-wide distribution; although it has been said to have the highest incidence in tropical and subtropical climates, it is always of potential danger when environmental sanitation is poor and crowded conditions exist.

It is known that *S. dysenteriae* occurs with relatively high frequency in the Orient; it must be emphasized, however, that it has been encountered in nearly all parts of the world. Outbreaks due to this type in the United States have been reported from New York, California, Missouri, Michigan, and Kentucky (31) (32) (33) (34) (35). It has been reported from Scotland, Germany, Egypt, the Philippines, and India (9), from Rabaul and Fiji (36). Since it was first described in Japan (7), it may be presumed to occur both endemically and in epidemic form there, and undoubtedly is being more widely disseminated during the present war.

S. ambigua was first recognized in Romania (7) and since has been shown to be widely distributed, having been reported in the United States, Scotland, Germany, Egypt, the Philippines, India (9) and Uruguay (37).

The flexneri types taken together show an extremely wide distribution and relatively high incidence (9). The separation of the group into serologic entities is too recent a development for adequate data on the various individual species to be available. Types I, II, and III are frequently encountered in nearly all parts of the world. Types IV and V were originally found in India (25) and were supposed to be rare in Europe. Both have been isolated in the United States (38).

The three strains of type VI are apparently quite common. The Newcastle variety has been responsible for numerous outbreaks in the United States and elsewhere, and the Boyd 88 culture had a relatively high incidence in India (25) and Uruguay (37), while the Manchester strain is believed to be a cultural variant of Newcastle. Type VII is reported to occur in many parts of the world (25) (28). Type VIII has been reported from various parts of Europe, Asia, Africa, and the United States (28).

Information regarding the rest of the flexneri types has been taken from Weil's data (28). Thus type IX has been found in the United States, India, and the Middle East; types X and XI have been recovered from cases in India and the Middle East, and in addition type XI was recently isolated from an epidemic in Puerto Rico. Types XII and XIII apparently are not very common, the few known strains originating from England, except one recently isolated in Uruguay (37). Type XIV has been reported from the United States, India, the Middle East, and Australia. Several

additional strains of the types IX to XIV have been very recently isolated.

S. alkalescens has a wide distribution throughout the world (6) (9) (38). *S. sonnei* has a very high rate of incidence, with apparently all geographic areas more or less involved (6) (9) (37) (38). Too little attention has been given the so-called "dispar" group to permit an estimation of the incidence of the various members of this category. The outstanding observation to be made regarding this brief discussion of type-incidence is that much more evidence is necessary before reliable conclusions can be drawn.

In order that Naval personnel may contribute to this important program, it is urged that establishments having adequate laboratory facilities increase their efforts toward the isolation and identification of shigella types. The Enteric Pathogen Laboratory, Naval Medical School, Bethesda, Maryland, is prepared to serve as a central point for the collection of cultures and epidemiologic data.

It is proposed that the information obtained will be analyzed and, together with freshly isolated strains, be made available to those concerned with the preparation of materials for prophylactic inoculation against bacillary dysentery.

PREVENTIVE MEASURES

In general the methods employed for the control of other enteric infections apply to the shigelloses (2) (12); there are, however, certain points that may well be emphasized. Since the natural habitat of the shigellas is the human intestinal tract, efforts should be made to detect individuals excreting the organisms, and whether they are apparently healthy, convalescent from an attack, or in the acute stage of the disease, such individuals should be isolated and precautions taken to avoid the transfer of organisms from their feces to the mouths of susceptible personnel. The "healthy" food handlers who harbor shigellas are a definite menace. Environmental sanitation is, of course, of extreme importance. The necessity for proper means of disposal of dejecta cannot be overemphasized. Safe water and milk supplies must be provided.

The preponderance of evidence incriminating flies in the dissemination of the organisms renders their control imperative. That flies may actually harbor shigellas in their intestinal tracts is indicated by the observations of Manson-Bahr (39). Of significance, particularly in tropical and subtropical zones, is the

observation that ants may carry shigellas on their feet for at least 24 hours after contamination (40).

There are perhaps four major preventive measures of a specific nature directed against the shigellas that have been suggested as means of control.

The conclusions of Boyd (23), previously mentioned in the discussion on bacteriophage, probably represent a fair consensus concerning this agent. Possibly more evidence under controlled conditions would serve to determine its prophylactic value. Sulfadiazine, sulfathiazole, and sulfaguanidine have been used successfully in the treatment of shigellosis and have been suggested for prophylaxis (9). This procedure might well be applied to personnel about to land in areas where bacillary dysentery is known to be prevalent.

The use of immune serum in prevention (41) has hardly undergone sufficient trial to justify any conclusion; a priori, it would appear to be extremely limited in applicability.

Adequate trials of vaccines for prophylactic inoculation have been delayed and but little definite information has been obtained since the first world war. One reason for unfavorable results has been the failure to recognize the necessity for using smooth, fully antigenic strains of shigellas in preparing vaccines, and it is now realized that these organisms are highly susceptible to variation (9). Considerable progress has recently been made along these lines (9) (28). Another difficulty has been the lack of adequate evidence on the prevailing types of shigellas in various geographic areas. The development of more accurate methods of specific diagnosis paves the way for gaining valuable information, and it is highly desirable that such data be obtained as early as possible.

Although the toxicity of shigella vaccines has been an objection to their prophylactic use, it appears possible to establish a dosage of organisms that will be a feasible compromise between antigenicity and unfavorable responses. Although there are many problems involved, the development of a suitable vaccine, perhaps analogous to T.A.B. vaccine, does not seem to be an insurmountable task.

SUMMARY

Shigellosis is a major cause of noneffectiveness of military personnel; the development of more efficient means of control, therefore, would be of immeasurable value to the war effort. Bacillary dysentery is a disease that is essentially limited to man. Methods of control of the spread of the causative organisms dependent upon environmental sanitation are not always easy to execute

when personnel land under combat conditions in areas where the disease is prevalent.

Present methods for the biochemic and serologic classification of the shigellas have been presented, together with suggested procedures in isolation and identification.

The prophylactic use of vaccines has been hampered by the lack of adequate data on the distribution of the various types of shigellas throughout the world, but recent developments have rendered the specific diagnosis of shigellosis relatively simple, and it is to be hoped that much valuable information can now be secured. Suggestions are made whereby this fund of data may be collected. It is possible that the prophylactic use of the sulfa drugs may prove to be of value in control measures.

REFERENCES

1. BARNES, L. A.: Pathogenic enteric bacilli; paracolon, proteus and pseudomonas groups. U. S. Nav. M. Bull. 43: 707-716, October 1944.
2. Idem: Pathogenic enteric bacilli; salmonella group. U. S. Nav. M. Bull. 43: 939-949, November 1944.
3. CALLENDER, G. R.: Dysenteries and diarrheas; their importance in military services. War Med. 4: 459-464, November 1943.
4. Idem: Diarrheal diseases. Am. J. Trop. Med. 24: 7-15, January 1944.
5. BULMER, E.: Survey of tropical diseases as seen in the Middle East. Tr. Roy. Soc. Trop. Med. & Hyg. 37: 225-242, February 1944.
6. ADAMS, J. W., JR., and ATWOOD, R. T.: Bacillary dysentery; bacteriologic and clinical analysis of 251 cases occurring in an Army camp. War Med. 5: 14-20, January 1944.
7. TOPLEY, W. W. C., and WILSON, G. S.: Principles of Bacteriology and Immunity. 2nd edition. William Wood & Co., Philadelphia, 1938. p. 538.
8. BERGEY, D. H.; BREED, R. S.; MURRAY, E. G. D.; and HITCHENS, A. P.: Bergey's Manual of Determinative Bacteriology. 5th edition. Williams & Wilkins Co., Baltimore, 1939. p. 470.
9. WEIL, A. J.: Progress in study of bacillary dysentery. J. Immunol. 46: 13-46, January 1943.
10. ANDREWES, F. W.: Dysentery bacilli; differentiation of the true dysentery bacilli from allied species. Lancet 1: 560-563, April 20, 1918.
11. NETER, E.: Bacteriological, epidemiological, immunological, and chemotherapeutic aspects of bacillary dysentery. Gastroenterology 1: 366-382, April 1943.
12. Notes on Tropical and Exotic Diseases of Naval Importance. National Naval Medical Center, 1943. p. 18.
13. STARKEY, D. H.: Case of *B. alkalescens* (Andrewes) bacteriae with serological confirmation. Canad. M. A. J. 31: 42-44, July 1934.
14. HARLY, A. V.; WATT, J.; and DECAPITO, T. M.: Studies of acute diarrheal diseases; new procedures in bacteriological diagnosis. Pub. Health Rep. 57: 521-524, April 10, 1942.
15. BANGXANG, E. N., and ELIOT, C. P.: Investigation of preserving solutions for recovery of dysentery bacilli from fecal specimens. Am. J. Hyg., Sect. B 31: 16-30, January 1940.

16. **BOYD, J. S. K.:** Laboratory diagnosis of bacillary dysentery. *Tr. Roy. Soc. Trop. Med. & Hyg.* 33: 553-571, April 1940.
17. **WOOD, A. J.; BAIRD, E. A.; and KEEPING, F. E.:** Primary division of genus *Shigella* based on trimethylamine test. *J. Bact.* 46: 106-107, July 1943.
18. **WEIL, A. J., and BLACK, J.:** Species differentiation within the genus *Shigella* by test for reduction of trimethylamine oxide. *J. Bact.* 47: 575-577, June 1944.
19. **SACHS, H.:** Report on investigation into characteristics of new types of non-mannitol-fermenting bacilli isolated from cases of bacillary dysentery in India and Egypt. *J. Roy. Army M. Corps* 80: 92-99, February 1943.
20. **CHRISTENSEN, W. B., and GOWEN, G. H.:** An arabinose-fermenting bacterium of the lactose-negative, mannitol-negative shigella group. *J. Bact.* 47: 171-176, February 1944.
21. **CARPENTER, P. L.:** Biochemical and serological properties of *Shigella* dispar. *J. Bact.* 47: 419-420, May 1944.
22. **KLIGLER, I. J.; OLEINIK, E.; and CZAZKES, I.:** Improved technic for isolation of dysentery bacteria from stools by formaldehyde inactivation of bacteriophage. *Am. J. Pub. Health* 33: 682-684, June 1943.
23. **BOYD, J. S. K., and PORTNOY, B.:** Bacteriophage therapy in bacillary dysentery. *Tr. Roy. Soc. Trop. Med. & Hyg.* 37: 243-262, February 1944.
24. **ANDREWES, F. W., and INMAN, A. C.:** Study of the serological races of the Flexner group of dysentery bacilli. *Med. Res. Council. Spec. Rep. Series No. 42*, Great Britain National Health Institute, London, 1919.
25. **BOYD, J. S. K.:** Antigenic structure of mannitol-fermenting group of dysentery bacilli. *J. Hyg.* 38: 477-499, July 1938.
26. **WHEELER, K. M.:** Antigenic relationships of *Shigella* paradysenteriae. *J. Immunol.* 48: 87-101, February 1944.
27. **NETER, E.:** Genus *Shigella* (dysentery bacilli and allied species). *Bact. Rev.* 6: 1-36, March 1942.
28. **WEIL, A. J.; BLACK, J.; and FARSETTA, K.:** Serological types of *Shigella* paradysenteriae (Flexner). *J. Immunol.* To be published.
29. **BORNSTEIN, S.; SAPHRA, I.; and DANIELS, J. B.:** Occurrence of *Salmonella* antigens in dysentery bacilli. *J. Immunol.* 42: 401-404, December 1941.
30. **STUART, C. A.; RUSTIGIAN, R.; ZIMMERMAN, A.; and CORRIGAN, F. V.:** Pathogenicity, antigenic relationships and evolutionary trends of *Shigella* alkalescens. *J. Immunol.* 47: 425-437, November 1943.
31. **PARK, W. H., and CAREY, H. W.:** Presence of Shiga variety of dysentery bacilli in extensive epidemic of dysentery with notes upon the serum reactions obtained. *J. Med. Res.* 9: 180-189, March 1903.
32. **REED, A. C.:** Bacillary dysentery in California. *Am. J. M. Sc.* 187: 819-826, June 1934.
33. **LAPP, T. S.:** Institutional outbreak of Shiga dysentery and its control. *J. Missouri M. A.* 33: 90-95, March 1936.
34. **BLOCK, N. B., and FERGUSON, W.:** Outbreak of Shiga dysentery in Michigan, 1938. *Am. J. Pub. Health* 30: 43-52, January 1940.
35. **CAUDILL, F. W.; TEAGUE, R. E.; and DUNCAN, J. T.:** Rural Shiga dysentery epidemic. *J.A.M.A.* 119: 1402-1406, August 22, 1942.
36. **MUMFORD, E. P., and MOHR, J. L.:** Manual on the distribution of com-

- municable diseases and their vectors in the tropics. Pacific Islands Section; Part 1. Suppl. Am. J. Trop. Med. 24: 1-26, May 1944.
37. **HORMAECHE, E.; SURRACO, N. L.; PELUFFO, C. A.; and ALEPPO, P. L.:** Causes of infantile summer diarrhea. Am. J. Dis. Child. 66: 539-551, November 1943.
38. **WHEELER, K. M.:** Serological identification of dysentery bacilli. Am. J. Pub. Health 34: 621-629, June 1944.
39. **DUDGEON, L. S.:** Dysentery group of bacilli. A System of Bacteriology 4: 199, 1929. Great Britain Medical Research Council, London.
40. **GRIFFITHS, S. D.:** Ants as probable agents in spread of shigella infections. Science 96: 271-272, September 18, 1942.
41. **FELSEN, J.:** Human convalescent serum and vaccination in prevention and treatment of bacillary dysentery. Mil. Surgeon 87: 417-423, November 1940.



POST-INFECTIOUS PSYCHOSIS, MALARIA

Post-infectious psychosis, malaria, is rare and exhibits no characteristic mental picture. Parasitized red blood cells are said to adhere to capillary walls, particularly during the second twenty-four hours of the parasites' asexual cycle. Occurring intracranially, this peculiarity can give rise to a great variety of neurologic pictures: Hemiplegias, epilepsies, syndromes of cerebellar or bulbar type, others simulating lethargic encephalitis or multiple sclerosis. Narrowly interpreted, it is an organic syndrome resembling mental sequelae of cerebral circulatory disorders, like embolism or thrombosis. More rarely it suggests psychosis with epidemic encephalitis, multiple sclerosis, and the like.—**HUDDLESON, J. H.:** Notes on psychoses and psychoneuroses with malaria. M. Bull. Vet. Admin. 21: 1-4, July 1944.



VITAMIN-C DEFICIENCY AND EXPERIMENTAL WOUNDS

The tensile strength of the wounds was found to vary with the daily dose of vitamin C given. Saturation with the vitamin was found not to be essential to optimal healing.

The general histologic appearance of wounds (by normal staining methods) did not necessarily give any indication of their tensile strength. There were more reticular fibres in the wounds which had a low tensile strength.

There was a correspondence between total blood vitamin C and wound tensile strength, and when the blood vitamin C was less than 0.1 mg. per 100 cc. a wound was likely to have a very low tensile strength.—**BOURNE, G. H.:** Effect of vitamin C deficiency on experimental wounds; tensile strength and histology. Lancet 1: 688-692, May 27, 1944.

DERMATOLOGIC CONDITIONS PREVALENT IN TROPICAL AREAS

TREATMENT WITH HEAVY DOSAGE OF ULTRAVIOLET RAY

KENNETH PHILLIPS

Lieutenant Commander (MC) U.S.N.R.

and

VICTOR B. BUHLER

Lieutenant Commander (MC) U.S.N.R.

In tropical and subtropical warfare areas, certain types of skin conditions constitute a prevalent and constantly annoying problem. Moreover it has been demonstrated that no conventional treatment has proved satisfactory, and none has given sufficient prophylactic or therapeutic results to justify general adoption. Experienced medical officers wisely caution against usage of iodine, salicylic acid compounds, and other strong keratolytic or antiseptic agents. These substances, although used with impunity in temperate zones, will often aggravate the existing lesion and even superimpose a second dermatologic problem when they are applied in tropical climates.

In view of these facts, any newly developed therapeutic procedure which indicates promise of results, justifies reporting.

The bactericidal and fungicidal powers of ultraviolet rays are well recognized, as are their properties of producing prolonged hyperemia of the skin, desquamation, pigmentary changes, and stimulation of vitamin and mineral metabolism. This study considers the technical application of ultraviolet in relation to the dosage employed.

During many years of clinical experience with ultraviolet rays, two relatively constant reactions have been observed. First, that with the application of the conventional small, frequent dose (multiple slight bombardments) the skin reacts by a defense mechanism. Erythema, desquamation, pigmentation, and tanning are gradations of this defense. As they progress, the skin tolerance to the ray increases markedly, sometimes even accepting a dose thirty times that of the original. Coincidentally, it was observed, that although a clinical response was manifest in the beginning, it quickly digressed in ratio to the developing defense reaction.

The second observation was that either inflamed, pathologic, or granulation tissue tolerates far greater initial dosage of the ray

without immediate tissue reaction. This is not surprising, considering the local biochemic changes which may be present or take place subsequent to exposure, due to existing vascularity, lymph flow, and so on.

These observations prompted a change in technic of application effected in two ways. First to spot only the lesion to be treated, and second, in place of multiple, graduated, minute daily doses, to follow the technic of roentgen therapy—strike with full dosage, rest for suitable interval—then strike again.

Pursuant to this line of reasoning, a definite treatment scheme has been devised based upon heavy initial and subsequent dosage, applied only to the pathologic area, with rest intervals between applications. The method has been observed over a period of fifteen months and the results fully justify its adoption.

METHODS OF STUDY

The fundamental principle of this entire scheme demands that each ultraviolet generator be standardized with sufficient frequency by the operator, so that he will know at all times the correct technical setup for an erythema dose of his particular unit. This procedure is not difficult, and the variations of different lamps are well known to all experienced operators.

Those dermatologic conditions encountered most frequently in the Pacific war theater, and which have shown refractive resistance to treatment, constitute the basic material for the study. Other less common conditions are reported for their adjunctive value.

A determination, relative to specific etiologic factors, in many of these cases proved difficult, because by the time the patient reached the consulting staff secondary factors had frequently been introduced. Attempts, nevertheless, have been made to throw all light possible upon this phase under these circumstances.

Patients were treated as received, without regard to special selection, thus avoiding any distinctive advantage to the therapy used. Controls, whenever practicable, were used, by choosing a single area or one side in bilateral lesions on the same individual. In many, however, when previous experience would assure us of a desired clinical result, such control was abandoned in favor of the rapidity with which the man could be restored to duty with a minimum loss of time.

Pathologic regions were treated by spot radiation with doses indicated in the tables, filtering and protecting all normal surrounding skin areas. Two wave lengths, 3200 and 1800 A.U., respectively, have been used.

Grouping according to diagnosis, and in tables, with etiologic and other factors included, seemed from a clinical viewpoint to be the most instructive form of case classification.

CLINICAL RESULTS

The impetiginous group (table 1) represents a typical skin condition which occurs in abundance in this area, and which is difficult to treat. Classical lesions of the face and axillae, papulopustular in type, with a tendency to spread unless immediately controlled, are its essential characteristics. The dosage to the face areas can always be heavier than that to the moist surfaces of the axillae. It was not uncommon to see vesicle formation in the latter areas, twenty-four hours following the initial treatment. In that event we have found it practicable to give a second dose, of one half the initial, at the end of this first 24-hour period. Contrary to what would be feared, in place of assaulting the lesions already produced, it seems actually to aid, and the amount of clearing of the impetiginous lesions within the subsequent 24 hours is dramatic.

A reasonable amount of local discomfort, chiefly itching and irritation, follows these heavy doses during the first 24 hours. Rarely do they reach any severity, and a small amount of mineral oil, locally applied, will control these annoyances.

The results are adequately conveyed in the table. This method of treatment has proved superior to any other therapy used in this area. It is of interest to note that sulfathiazole ointment seemed to aggravate these conditions.

The relative incidence of acne (table 2) is not certain; but it is encountered in abundance in this area in the age group in military service. Its resistance to conventional treatment is well recognized. Except psoriasis, probably in no other group is correct dosage more important. A deep desquamating dose is required. Those patients reacting in 24 hours with a deep port-wine color to the treated area, respond with the best results. It is in no way contended that a cure of acne is achieved, nor is proper insight lost of various metabolic factors associated with the condition. However the remarkable local improvement observed in these cases has far outweighed other conventional measures including vaccines and x-ray. In the twenty cases listed as "apparent cures," characteristic diffuse lesions were present, especially on the face. They were seen prior to receiving multiple previous therapy, which was not the case in the chronic cases. The local lesions disappeared and the skin remained normal during the several months

TABLE 1.—*Impetiginous lesions*

Cases	Lesions and locations	Etiologic factors	Ultraviolet dosage	Clinical results
26	Typical papulovesicular lesions of face and neck.	Usual ascribed.	Avg. 6 to 8 E.D.s at 4- to 5-day intervals.	Began clearing 24 hrs. and complete in 5 days...22 Complete clearing in 8 days...2 Failures...2
11	Typical lesions, both axillae.	Usual cause.	Avg. 6 to 8 E. D.s at 3- to 4-day intervals.	Cleared in 3 to 5 days...11

Key: E.D. = (Erythema doses)

TABLE 2.—*Chronic refractive acne*

Cases	Lesions and locations	Etiologic factors	Ultraviolet dosage	Clinical results
35	Papular and pustular type limited to face with minor neck lesions. Both adolescent and young adult types included. Previous treatment of various kinds in 28 cases.	Staph. aureus or albus cultured in 15; others not cultured.	Avg. 10 to 14 E.D.s at 5- to 7-day intervals. Dosage reduced as lesions improved.	Deep initial reddening with heavy desquamation...32 Marked improvement...20 Apparent cure...3 Failures...3
10	Chronic lesions involving face, neck and chest. Deep papules, some pustules, much scarring.	Not definite. Many types. Previous treatment with failure. All recrudescent.	Avg. 4 to 6 E.D.s at 3- to 5-day intervals. Total six treatments.	Arrest of activity with moderate improvement...4 Slight improvement with prolonged action of recrudescence...2 Failures...4

TABLE 3.—*Eczematoid: localized, chronic, recurrent*

Cases	Lesions and locations	Etiologic factors	Ultraviolet dosage	Clinical results
10	Elbows, in many cases including hands.	Often contact factor but treated regardless.	Avg. 3 to 5 E.D.s at 2- to 5-day intervals.	Frequent slight irritation from initial dose, then improvement...6 Lesions clear in 10 days...1 Lesions clear in 14 days...3 Failures...3
7	Ankles and upper dorsum of feet. One complicated by treatment irritation.	No allergic studies.	Avg. 3 to 5 E.D.s at 2- to 3-day intervals.	Cleared in 10 days...4 Failures...2 Aggravated...1

of observation. Nothing positive can be claimed relative to recurrence. In the chronic and complicated cases the improvement was definite and worth while except in the few who did not respond at all to the therapy.

The localized eczematoid group (table 3) represents an uncertain group, undoubtedly due to the many factors concerned in its causation. Detailed allergic studies and treatment along these lines are impractical in the field, and even in areas where they can be carried out the results are often disappointing. The main therapeutic object is the return of these men to active duty. In the group studied, no criterion has been evolved by which the type which will respond to therapy can be selected or anticipated. Many of these cases, however, are found to be aggravated by topical chemical treatment. More cases were studied than have been included in the table, since several were discarded because of uncertain results, transferred before proper treatment or observation could be completed, and other uncontrollable factors. It is felt that 40 to 50 percent of an average group will respond favorably to the therapy.

No skin condition in the tropics presents a more harassing problem than do the various fungus infections (table 4). They are abundant in occurrence, resistant to therapy, susceptible to extension and secondary invasion, and responsible for a tremendous amount of disability in the military forces.

The etiology was mixed by the time the patients came under observation, for they were practically all of long standing. Yeasts were isolated from many lesions; various secondary invaders from others. Conventional salicylic acid compounds, especially the salves, usually produced a marked aggravation from chemical irritation. Table 4 is self-explanatory relative to results, but further emphasis should be made on hygiene of the feet. In 80 percent of the patients seen, the shoes worn were too short and too narrow. So impressive was this observation that the measurement of all feet by a commercial scale and the wearing of properly fitting shoes have been established as a routine part of the therapy, as also the irradiation with large doses of ultra-violet to the insides of the shoes.

Involvement of the external ear and canal is usually associated with much swelling and inflammatory reaction. The dosage inside the canal must be reduced because further immediate reaction from the ray may occlude an edematous canal and cause much distress. The treatment is accomplished by plugging the canal with cotton while a full dose is directed to the lobe. A filter is

TABLE 4.—*Fungus infections; complicated*

Cases	Lesions and locations	Etiologic factors	Ultraviolet dosage	Clinical results
15	Feet: between toes, dorsum and plantar surfaces.	Eczematoid and secondary invasion complications in all. Yeast invasion often isolated.	Avg. 5 to 8 E.D.s at 4-day intervals. Shoes irradiated (inside) with 16 E.D.s, and corrected to proper fit.	Cleared in 14 days. Improvement.....12 Failures.....1
10	Ears—external canal.	Mixed type.	Avg. 3 E.D.s at 2- or 3-day intervals with official applicator.	Cleared in 7 days.....10
7	Buttocks or trunk.	Tinea circinata lesions.	Avg. 6 to 8 E.D.s at 3- to 5-day intervals.	Rapid response and cure.....3 Improvement, unable to follow up.....4
2	Groins and inner thighs.	Tinea circinata lesions.	Avg. 6 to 8 E.D.s at 3- to 5-day intervals.	Rapid cure.....2

TABLE 5.—*Miscellaneous skin conditions*

Cases	Lesions and locations	Etiologic factors	Ultraviolet dosage	Clinical results
5	Anterior surface, both legs.	Erysipeloid character. Chills and fever at onset.	Avg. 5 E.D.s at 3-day intervals.	All cleared in 48 hours with negligible or no pigmentation.
9	Legs—dorsal or lateral surfaces.	Trophic or vascular, indolent, chronic, circumscribed ulcers.	Avg. 8 to 10 E.D.s at 4-day intervals.	Marked improvement 14 days.....5 Moderate improvement 14 days.....2 Failures improvement 14 days.....2
5	Face 3, chest 2.	Herpes zoster.	Avg. to involved ganglia 4 to 6 E.D.s. To the skin lesions 4 to 6 at 3-day intervals.	Relief from pain, improvement in lesions 48 hours.....2 Failures.....3
2	Arms and back and chest.	Lichen planus.	Avg. 6 to 8 E.D.s at 3- to 4-day intervals.	Both cleared rapidly.
2	Scalp, heavy involvement. Scattered lesions trunk and limbs.	Psoriasis.	Avg. 6 to 8 E.D.s at 3- to 5-day intervals.	A dramatic clearing of all lesions within 10 days.
5	Diffuse miliarial type of maculopapular rash seen frequently in area of study.	Heat, moisture, and general tropical conditions.	Avg. 5 to 6 E.D.s at 4- to 5 day intervals.	Rapid clearing in all.

then inserted, and the reduced dose outside the canal is applied with the orificial applicator.

The over-all results with the fungus group have been most encouraging.

The miscellaneous group (table 5) is presented chiefly to call attention to certain possibilities. Too few cases have been observed for any definite opinions to be formed. Of the group the most dramatic responses were obtained in those cases occasionally encountered with erysipeloid lesions of the legs, associated with chills and fever at the onset, and in the psoriatic cases. Heavy desquamating doses applied to psoriasis of the scalp brought about remarkable responses.



NUTRITIVE VALUE OF CANNED AND DEHYDRATED MEATS

Dehydration or canning of meat does not greatly reduce its nutritive quality. The greatest of the changes which do take place occur in the thiamine and pantothenic acid potencies. Likewise, storage of processed meats at moderate temperatures does not affect their food value except for loss of thiamine. Under ordinary storage conditions the other vitamins appear to be stable for indefinite periods.

Since dehydrated or canned meats are already cooked, they may be consumed as purchased, merely warmed, or mildly cooked in combination with other foodstuffs. Losses in preparation for consumption, therefore, are slight.—RICE, E. E., and ROBINSON, H. E.: Nutritive value of canned and dehydrated meat and meat products. *Am. J. Pub. Health* 34: 587-592, June 1944.



VITAMIN RETENTION IN HAM

The thiamine, riboflavin and nicotinic acid retentions during the curing of pork hams have been studied using two methods of calculation. When calculated on the basis of the total vitamin content of the fresh and cured ham, 80 percent of the thiamine, 97 percent of the riboflavin, and 100 percent of the nicotinic acid were retained. When calculated on the basis of the vitamin content per gram of protein in the fresh and cured hams, 85 percent of the thiamine, 104 percent of the riboflavin and 106 percent of the nicotinic acid were retained.—SCHWEIGERT, B. S.; MCINTIRE, J. M.; and ELVEHJEM, C. A.: Retention of vitamins in pork hams during curing. *J. Nutrition* 27: 419-424, May 1944.

CHEMOTHERAPY AND X-RAY RADIATION IN TREATMENT OF CELLULITIS OF THE HEAD AND NECK

SAMUEL S. WALD
Commander (DC) U.S.N.R.

At the U. S. Naval Hospital in Brooklyn, N. Y., over 100 cases of cellulitis of the head and neck were treated with chemotherapy and/or x-ray radiation. When penicillin was used no x-ray therapy was employed. Ninety-five percent of these cases occurred following the removal of lower third molars and 5 percent were due to pericoronal infection following the removal of various upper and lower teeth.

These cases in the main presented the following picture: The patients appeared to be very sick and listless, most of them had elevated temperatures on admission, some as high as 105.6°F., and all had diffuse, hard, indurated swelling, with trismus and involvement of the glands of the neck. Over 50 percent had involvement of the lymphatic tissues of the throat and pharynx simulating Ludwig's angina. In this group there was no evidence of suppuration at any time. Many fatalities have been reported in cases of this type, and many cases that became chronic resulted in some instances in permanent disfigurement. Good results were obtained in all cases and there were no fatalities in this series.

Sulfathiazole and x-ray therapy were used in most of these cases. When sulfathiazole was not tolerated, sulfadiazine was substituted. Penicillin was used whenever the sulfa drugs were contraindicated. With penicillin, x-ray therapy was not given. The penicillin dosage was 3 cc. or 15,000 units (100,000 units of penicillin dissolved in 20 cc. of isotonic saline solution), given intramuscularly every 3 hours. The average total dose varied from 1,000,000 to 2,000,000 units. In the old chronic fistulous cases this medication was supplemented by 10 cc. or 5,000 units (100,000 units dissolved in 200 cc. of isotonic saline solution), placed into the sinus or used topically every 6 hours as a wet dressing kept continuously hot.

With sulfadiazine a blood level of about 7 to 8 mg. per 100 cc. of blood was effective. With sulfathiazole a blood level concentration of about 5 to 6 mg. per 100 cc. of blood was maintained. To obtain this concentration the average case required 3 gm. as an initial dose and 2 gm. every 4 hours for the first 24-hour period. After that 1 gm. was given every 4 hours indefinitely. Sulfonamide

medication was continued until temperature and symptoms subsided, the average period being 7 to 10 days. Repeated complete blood counts, including the differential count, sulfa levels, urinalyses, and general physical examinations are made throughout the period of therapy.

Contraindications for the use of sulfathiazole are: (1) Nausea and rash (change to sulfadiazine); (2) toxicity; (3) leukopenia (leukocyte count under 4,000), hemolysis and low erythrocyte count; (4) signs of kidney damage; and (5) drug fever.

The x-ray therapy was given in the following doses: 150 r on the first day (120 kilovolts, 5 milliamperes, at a 25-cm. distance, using a filter of 2 mm. of aluminum), repeated every other day for a minimum of three applications, giving a total dose of 450 r. This radiation will penetrate approximately 2 cm. below the skin surface. A few patients were given an additional 150 r. The total dosage should never exceed 600 r.

Ward care included abundant fluids, calibrating the intake and output. An average intake of 3,000 to 3,500 cc. of fluids daily is attempted with output of between 40 percent and 60 percent of the intake. Continuous external application over the affected area, of hot hypertonic saline wet dressings, and hourly intra-oral irrigations with hot saline solution were prescribed. Mild sedatives consisting of $\frac{1}{2}$ grain of codeine sulfate and 10 grains of acetylsalicylic acid were given, and a daily laxative if indicated.

After 24 hours of treatment there was little discomfort and no pain despite temperature and swelling. The average time of treatment was 1 to 2 weeks. The response to treatment was spectacular. In 85 percent of the cases no other treatment was indicated; the patients got well without any surgical interference and there was no evidence of suppuration. In the remaining cases in which suppuration was present, the infected areas became localized and responded well to extra-oral incision and drainage. Incision is not resorted to until these areas are well localized and present the cherry-red color of fluctuation. The patients were comfortable at all times and deep infection was apparently warded off.

Certain cautions should be observed. The proper timing of extractions and preparation of the patient for extraction are most important. Incising for drainage should not be done at the temporomandibular region. Incisions should be made in the lines of skin cleavage and below the mandible whenever possible. Premature surgical trauma and tissue irritation should be avoided. Time should be allowed for the body to work up its own resistance. If airways are interfered with, tracheotomy may be indicated.

In this series there were no apparent ill effects from the sulfona-

mide medication, x-ray therapy, or penicillin. Proper fluid intake and output is the most important factor in avoiding ill effects from the sulfa therapy. Vitamin B complex should not be given with any of the sulfa drugs as it causes them to be ineffective. The bacteria synthesize the amino acids from the para-aminobenzoic acid and thus maintain their nutrition. Novocain also inactivates the sulfa drugs; local application of the sulfa drug is ineffective until the novocain has been entirely absorbed, which is usually within a few hours.

When suppuration is present locally, the area should first be irrigated with an azochloramid solution before application of the sulfonamide. Suppuration also inhibits the action of sulfa drugs as the bacteria can be well nourished from the suppurative material.

One of the cases in this group seems worthy of reporting in detail.

Case report.—A seaman, second class, age 26, while serving at sea developed pain and swelling in the area about an erupted lower right third molar, and was referred to a Naval hospital for treatment on 11 May 1943. At that time there was swelling of the right side of the mandible, elevation of the temperature and trismus of the jaws. He was placed immediately on a regime of sulfadiazine, 2 gm. every 4 hours, and routine care. One week later when symptoms had subsided, the lower right third molar was removed. This was followed with more marked swelling, trismus, elevation of temperature and involvement of the glands of the neck and throat. The patient experienced extreme pain necessitating constant sedation. Nine days later, using sodium pentothal intravenous anesthesia, an area beneath the angle of the right mandible was incised and a gauze drain inserted.

The patient's condition did not improve and active suppuration was present. On 1 July, with the patient under pentothal anesthesia, the area beneath the angle of the right mandible was again incised, this time more radically, and a drain inserted. After operation, the patient was given 5 gm. of sulfadiazine followed by 2 gm. every 4 hours.

On 15 July, again using pentothal anesthesia, the area under the right mandible anterior to the angle of the jaw was incised and a rubber drain was inserted.

The condition became chronic with active suppuration continuously present and frequent episodes of acute flare-up. Sulfadiazine was discontinued on 10 August 1943 after being administered continuously for a period of 3 months, and intramuscular injections of liver extract, 1 cc. every other day, were given for a period of 3 months.

On 12 August marked swelling appeared about the right temporomandibular region, and using ether inhalation anesthesia, areas at the temporomandibular region and below the angle of the right mandible were incised and rubber drains inserted. The patient was discharged to duty on 16 December, although slight suppuration was present from both sites of incision. and there was slight swelling and trismus of the jaws. This condition persisted while the patient was at sea and again became acute in February 1944 at which time he was sent to this hospital.

On admission there was marked swelling of the right side of the face, extending from the temporomandibular region to the neck with involvement of the glands of the neck and throat. The region was very red and was painful to touch. Edema was so marked that the right ear was not visible from a front view. Suppuration was present from the sites of incision. There was complete trismus of the jaws, and the patient's temperature was elevated.

Results of a general physical examination revealed nothing pertinent to the case. Roentgenographic examination of the teeth, jaws, sinuses, temporomandibular articulation, and chest disclosed no abnormalities. Except for a leukocyte count of 15,000, hematologic findings were negative, as were those of a blood Kahn test and urinalysis. A smear of the suppurative matter revealed many pus cells and occasional gram-positive diplococci. *Staphylococcus albus*, hemolytic and nonhemolytic colonies, aerobic and anaerobic, were found on culture. A special culture was negative for actinomycetes. Blood culture revealed no growth after 6 days. The blood sedimentation rate was 28.

The patient was placed on a treatment regime of penicillin on the second day after admission, 3 cc. (15,000 units dissolved in isotonic saline solution) being given intramuscularly every 3 hours, and 10 cc. of a dilute solution of 100,000 units dissolved in 200 cc. of isotonic saline solution used topically to irrigate the suppuration sites, the overflow being used as a wet dressing. This was repeated every 6 hours, and a hot water bottle was kept over this wet dressing continuously.

After 24 hours marked improvement was noted. The suppuration had ceased completely and the fistulas were dried and appeared to be healing. The condition continued to improve for 10 days, but on the eleventh day an acute flare-up with marked swelling occurred. On the fourteenth day the area was well localized and fluctuant. The area under the right angle of the mandible was incised at the site of the old scar. Much suppurative and cheesy matter was evacuated and an iodoform gauze drain was placed into the site of incision.

Penicillin was discontinued on the fourteenth day. The total dosage of penicillin given was 1,350,000 units intramuscularly, with an additional 280,000 units used as irrigation into the suppurative sites and as topical wet dressings. The condition became chronic with occasional episodes of acute flare-ups, and incision and drainage had to be resorted to on two more occasions. Physiotherapy was started on 13 March 1944 with no particular response. On 27 March sulfathiazole, 2 gm. every 4 hours for the first 24-hour period was given, followed by 1 gm. every 4 hours for a period of 12 days. The total dosage of sulfathiazole was 78 gm. This dosage produced a blood level concentration of about 5.3 mg. per 100 cc. of blood.

The sulfa medication was supplemented by x-ray therapy in the following dosage. On the first day 150 r with the following factors: 120 kilovolts, 5 milliamperes at a 25-centimeter distance, using a filter of 2 mm. of aluminum. This radiation was repeated every other day for two more doses, making a total dose of 450 r. During this period the patient was given abundant fluids with intake and output calibrated, the patient averaging about 3,500 cc. intake of fluids daily. Application over the affected area of hot hypertonic saline wet dressings, over which a hot water bottle was placed, was maintained continuously, and the patient received hourly intra-oral irrigations with hot saline solution.

The patient responded well to this treatment. For the first time since his

illness he is entirely comfortable and his jaws are functioning well. There is no evidence of any suppuration or swelling and the tissues are well healed.

This patient did not respond to sulfadiazine alone, as apparently sulfadiazine had no particular effect on the invading organisms in spite of a high blood level concentration (about 15 mg. per 100 cc. of blood). Penicillin, although apparently effective at the beginning, was entirely ineffective in spite of a high blood level over a long period of time. Incision and drainage combined with physiotherapy were ineffective. The combination of sulfathiazole and x-ray therapy, however, was successful in combating the infection.



CINCHONA ALKALOIDS AND PLASMA CONCENTRATIONS

Studies of the plasma concentrations, after taking oral doses of quinine, quinidine, cinchonidine, cinchonine, and totaquine, were made. With equivalent doses there are marked differences in the plasma concentrations reached after taking different cinchona alkaloids. Quinine gives the highest concentrations, cinchonidine and quinidine next, while cinchonine gives very low plasma concentration. The plasma concentration after administering totaquine is about what would be expected from the additive effect of the constituents. The plasma concentration of any of the alkaloids is markedly lower if the dose is administered immediately after a meal.—HIATT, E. P.: Plasma concentrations following oral administration of single doses of principal alkaloids of cinchona bark. *J. Pharmacol. & Exper. Therap.* 81: 160-163, June 1944.



VITAMIN CONTENT OF PREPARED MEATS

Prepared meats were found to be a good source of vitamins; they contain about the same amounts as fresh muscle meats. Retention of these vitamins in some of the meats was studied during broiling, braising and boiling. Greater amounts of all the vitamins were retained in the meat after broiling than after braising. In the case of boiling the vitamin retention in the meat was dependent on the cooking time. Broiling favored a higher total retention of thiamine than did braising. In nearly every case over 90 percent of the nicotinic acid and riboflavin was recovered in the meat and drippings.—MCINTIRE, J. M.; SCHWEIGERT, B. S.; HERBST, E. J.; and ELVEHJEM, C. A.: Vitamin content of variety meats. *J. Nutrition* 28: 35-40, July 1944.

TREATMENT OF SKIN DISEASES ON AN ATTACK TRANSPORT

USE OF UNDECYLENIC ACID

WALTER J. McCANN

Lieutenant Commander (MC) U.S.N.R.

Numerous reports in the literature on the prevalence of skin diseases aboard Naval vessels have been in agreement that in order of frequency they are trichophytosis, miliaria rubra, impetigo contagiosa, furuncles, pediculosis pubis, and scabies. In general also the same causative factors have been given, that is, overcrowded quarters, the high temperatures of the tropics, failure of the crew to clothe themselves properly, spread of diseases from contact with shower floors and head seats, and inability to bathe frequently because of water shortages.

In tropical climates skin diseases flourish and spread despite preventive efforts. Attack transports frequently evacuate troops from forward areas, and these men usually have multiple skin lesions which are loosely described under the general generic term of "jungle rot." It includes trichophytosis, miliaria rubra, impetigo contagiosa, furuncles, multiple insect bites, and contact with tropical fauna. The impetiginous and ringworm lesions are strikingly infantile in nature. Transients act as continued pools of infection. Despite repeated warnings, a ship's company has to be made to wear proper clothing. Failure to do so increases the spread of skin diseases, adds to their chronicity, and produces an added factor, contact dermatitis from shoes.

Little has been said concerning the morbidity from these skin diseases. Many of the crew have spent valuable days in the sickbay with secondary cellulitis and adenitis, and one man spent a total of 65 days in the sickbay (in divided periods during 7 months) because of epidermophytosis of both feet aggravated by contact dermatitis and cellulitis.

Men do not come to sickbay for treatment of tinea cruris (jockey-strap itch, dhobie itch, red flap, eczema marginatum), until it is far advanced. It is commonly called "jockey itch" by the men, and is presumed to have been the result of friction from underwear, even though the infected man may not have worn underwear for some time.

It is obvious that the present methods of control are inadequate. The same men appear at sick call daily. They paint the lesions with "fungus paint" or smear them with some salicylic ointment preparation, but the lesions remain. There is no doubt that increased humidity and perspiration add impetus to the development of the lesions and probably give them their infantile character.

In an effort to control this condition, two preparations of undecylenic acid were obtained from Dr. J. G. Hopkins, professor of Dermatology and Syphilology, College of Physicians and Surgeons, Columbia University. The one was a liquid, containing 2-percent undecylenic acid, 1½-percent triethanolamine, and 0.01-percent acriflavine in secondary butyl alcohol. This preparation stings slightly when first applied and should not be used where there is pronounced fissuring and denudation. The other preparation was an ointment containing the same amounts of the fungicide and the bacteriostatic substance in a wax and peanut oil base. If irritation in the groin occurs, the part may be painted with gentian violet or a sulfathiazole ointment until the inflammation has gone down, and then the use of the ointment resumed.

The most severe cases were isolated. When the skin became inflamed by the drug a rest period was instituted. Topical applications were stopped and the skin was dusted with the following powder until the inflammation subsided.

	<i>Gm. or cc.</i>
Menthol	30
Camphor	60
Boric acid	60
Talc q.i.d.	1,000

Dissolve camphor and menthol in 15 cc. alcohol and mix.

It is not possible to hospitalize and isolate all cases except during periods when the ship is less active. Cured cases remove at least one link in the chain of infection.

Miliaria rubra attacked most of the crew at some time or other. The galley and engine room crews were most often affected. Exposure to the sun and air produced the best results. Patients were marked with an "M" with merthiolate and allowed to expose themselves on the deck. Before resuming work they were all dusted with the powder described above.

In regard to pediculosis pubis satisfactory results have been obtained with one of the more common commercial insecticides. Its use precludes the necessity of preparing other formulas. Shaving is dangerous where typhus is endemic. Ointments are greasy and messy; camphor and phenol mixtures have caused ulcerations in sensitive skins.

Impetigo occurs so frequently that it can be considered endemic. Patients should be instructed to dissolve the crusts with tincture of green soap before the application of sulfathiazole ointment or ammoniated mercury. Ointments such as these will not penetrate thick blebs and scabs. As soon as we arrive in an area where a mobile hospital is located these patients are referred there for x-ray therapy in suberythema doses.

The multiplicity of skin infections would puzzle all but the most experienced dermatologist. The patients may have contracted their condition in the tropics, but the condition is not necessarily tropical. One patient had a severe generalized pruritus which had baffled many medical officers, probably because of the time factor, the distribution of the lesions, but chiefly because the patient would state, "It's a tropical skin disease I picked up in Noumea." True, it did not look like the typical textbook picture of scabies but scabies it was. It was cured by benzoic acid, soft soap and alcohol.

It is recommended that in the treatment of trichophytosis, undecylenic acid should be further investigated; that the men should be forced to wear socks, shorts, and undershirts; that skin lesions should be kept dry; that individuals with infectious skin diseases should be kept in the sickbay whenever possible until they are cured; and that there should be continued education of the ship's company in regard to skin infections, particularly *tinea cruris*.



PHTHALYLSULFATHIAZOLE IN THE DIARRHEAS

Phthalylsulfathiazole has proved to be highly specific in the treatment of (Flexner) bacillary dysentery. This therapeutic result could be anticipated from the experimental observations that the drug is quite effective in inhibiting the growth of coliform bacteria in the presence of a watery diarrhea, and that a relatively high concentration of a diazotizable derivative is maintained in the feces.

It has, furthermore, been observed that patients suffering from diarrheas, but in whom the *Shigella paradysenteriae* organisms could not be identified, frequently respond promptly following the administration of phthalylsulfathiazole. Ordinarily, the most satisfactory therapeutic regimen is to give 0.04 gm. of the drug per kilogram of body weight every four hours for 12 doses and then 0.02 gm. per kilogram at 4-hour intervals until diarrhea ceases or for a total of 7 days if the diarrhea is proved to be a bacillary dysentery.—POTH, E. J., and ROSS, C. A.: Clinical use of phthalylsulfathiazole. *J. Lab. & Clin. Med.* 29: 785-808, August 1944.

BIOSTATISTICS IN MEDICAL RESEARCH¹

I. SIGNIFICANT DIFFERENCES

H. M. C. LUYKX

Lieutenant H-V(S) U.S.N.R.

In medical research (as in other branches of science) the results of experimentation are frequently expressed in percentages to be compared with each other. For example, to test the effectiveness of a remedy, it is administered to a group of individuals, A, and the percentage recovering within 24 hours is noted. As a control, a comparable group, B, receives no remedy, and the percentage recovering within 24 hours in this latter group is noted.

If groups A and B are similar in every respect except the administration of the remedy, then the effectiveness of the remedy may be judged by the difference between the observed percentages, *provided this difference is significant*. To form such a judgment, therefore, requires a knowledge of (a) the meaning of the word "significant" as used in a statistical sense, (b) how to determine whether a difference is significant, and (c) the limitations surrounding the proper use of a significance test.

Significance defined.—A significant difference, statistically, is a difference larger than one which could reasonably be expected to occur due to chance alone. This depends on two factors: (1) The magnitude of the percentages observed, and (2) the number of subjects observed in each group. For an example, let us say that in group A, receiving medication, there are 55 patients and 63.6 percent of them recover, and in group B there are 62 patients with 48.4 percent recovery. The difference between these percentages is 15.2. A significance test tells us that if the remedy had no effect at all, so that groups A and B would then be the same in all respects, a difference in percentage as large as 15.2 could occur due to chance alone about once in every ten such experiments.

As another example, let us say that in group A there are 374 patients, of whom 62.3 percent recover, and in group B, 488 pa-

¹ Part II of this article, Probabilities in Small Samples, will appear in the January number of the BULLETIN. Part III, Samples which are 100-Percent Positive, will appear in the February issue.

tients show 51.2 percent recovery. The difference here is 11.1 percent, and the significance test shows that this difference could occur due to chance alone (assuming the remedy to have no effect at all) in about one experiment out of a thousand.

In the first example (example I) the difference *is not significant*. One experiment out of ten is not an unlikely event. The experiment actually conducted could easily be that one, and therefore it may not be said that there is evidence that the remedy was effective.

In the second example (example II) the difference *is significant*. One experiment out of one thousand is an unlikely event, which means that one would not expect to find a difference as large as the one observed if the remedy were not effective. From this finding it is deduced that the remedy was effective, assuming, of course, that the medication is the *only* difference between groups A and B. It is important to remember that significance means only a difference larger than could reasonably be expected due to chance and nothing more. There is always the possibility that example II happened to be that one experiment in one thousand which was due to chance. This is so unlikely, however, that such a possibility is usually denied in actual use.

Suppose that by other means good evidence was presented to show that the remedy had no effect, but that a difference which could be expected only once in one thousand times had been found. That difference would then most likely be caused by some factor other than the remedy, i.e., groups A and B must not have been comparable in all respects other than medication. This points to the importance of making the control group, B, similar to the test group, A, in order to be able to say that medication was the cause of the observed difference.

THE SIGNIFICANCE TEST

The mechanics of a significance test are not complicated, and will be outlined without attempting to explain the logic of every step. The theory of such a test may be learned by consulting any good textbook on statistics (see bibliography), and it is urged that this be done if the research worker has occasion to apply significance tests to data which do not resemble the examples cited here.

In order to evaluate the significance of a difference, one must know the two percentages which will show this difference and the total number of subjects in each group.

EXAMPLE I.

	Group A	Group B
Percent recovery	63.6	48.4
Number of subjects.....	55	62

Step 1.—A four-part table is then constructed from these numbers as follows:

Group	Number recovered	Number not recovered	Total subjects	Percent recovery
A	35	20	55	63.6
B	30	32	62	48.4
Total.....	65	52	117	.....

Each of the numbers in this table is needed in calculating the difference between the groups; they are obtained by simple arithmetic from the four numbers given. If the original example did not give both percentages and the total number in each group, but did provide sufficient data to complete the four-part table, that would be sufficient information for this test.

Step 2.—Next, “x,” the difference between the two percentages expressed as true numbers, is calculated.

$$\begin{array}{rcl}
 63.6 \text{ percent} & = & 0.636 \\
 48.4 \text{ percent} & = & 0.484 \\
 \hline
 x & = & 0.152
 \end{array}$$

This is the original percentage difference expressed as a pure decimal.

Step 3.—Sigma (σ) is calculated according to the following formula:

$$(\sigma) = \sqrt{\frac{n_a n_b}{n_1 n_2 N}}$$

where n_a , n_b , n_1 , n_2 , and N are the marginal totals of the four-part table, as follows:

$$\begin{array}{ll}
 n_a = 65 & n_2 = 62 \\
 n_b = 52 & N = 117 \\
 n_1 = 55 &
 \end{array}$$

It will be noted that in the fraction under the square root sign, the two totals in the numerator are the two totals in the bottom row of the four-part table, i.e., the total number recovered in both groups and the total number not recovered in both groups. The

three factors in the denominator of that fraction are the three totals at the right, i.e., the two totals of groups tested, as given originally, and the sum of these two numbers. Thus:

$$\sigma = \sqrt{\frac{65 \times 52}{55 \times 62 \times 117}} = \sqrt{0.008472} = 0.09204$$

Step 4.—Calculate x/σ :

$$\frac{x}{\sigma} = \frac{0.152}{0.09204} = 1.65$$

This is the number which has various names in statistical terminology, such as "relative deviate," "critical ratio," etc., and is as frequently called simply "x over sigma."

Step 5.—In table 1 the value of P, which corresponds to the x/σ just obtained, may be found. In this case, by interpolation, P is approximately 0.0994.

TABLE 1.—*The probability of obtaining a difference at least as large as the one observed due to chance*

$\frac{x}{\sigma}$	P	$\frac{x}{\sigma}$	P	$\frac{x}{\sigma}$	P
0.0	1.0000	1.5	0.1336	3.0	0.0027
0.1	0.9203	1.6	0.1096	3.1	0.0019
0.2	0.8415	1.7	0.0891	3.2	0.0014
0.3	0.7642	1.8	0.0719	3.3	0.0010
0.4	0.6892	1.9	0.0574	3.4	0.0007
0.5	0.6171	2.0	0.0455	3.5	0.0005
0.6	0.5485	2.1	0.0357	3.6	0.0003
0.7	0.4839	2.2	0.0278	3.7	0.0002
0.8	0.4237	2.3	0.0214	3.8	0.0001
0.9	0.3681	2.4	0.0164	3.9	0.0001
1.0	0.3173	2.5	0.0124	4.0	0.00 006
1.1	0.2713	2.6	0.0093	5.0	0.00 000 06
1.2	0.2301	2.7	0.0069	6.0	0.00 000 000 2
1.3	0.1936	2.8	0.0051	7.0	0.00 000 000 000 3
1.4	0.1615	2.9	0.0037		

x = the observed difference.

σ = the standard deviation of the normal distribution of differences for the samples observed.

P = the probability of obtaining a difference as large as, or larger than, the one observed, due to chance alone.

P is the probability of obtaining a difference as great as, or greater than x due to chance alone, under these circumstances. Since P is practically 0.1, it may be said that a difference as large as the one observed could arise due to chance alone about once in every ten experiments, and this difference was therefore not significant.

EXAMPLE II. In this example the same steps are followed.

	Group A	Group B
Percent recovery	62.3	51.2
Number of subjects.....	374	488

Group	Number recovered	Number not recovered	Total subjects	Percent recovery
A.....	233	141	374	62.3
B.....	250	238	488	51.2
Total.....	483	379	862	.....

$$\begin{aligned} \text{Difference} &= 11.1 \\ x &= 0.111 \end{aligned}$$

$$\sigma = \sqrt{\frac{483 \times 379}{374 \times 488 \times 862}} = \sqrt{0.001164} = 0.03412$$

$$\frac{x}{\sigma} = \frac{0.111}{0.03412} = 3.25$$

$$P = 0.0012 \text{ (approximate)}$$

$P = 0.001$, means the chances are about one in one thousand of obtaining a difference as large as this according to the laws of probability. Since this is such a small chance, it may be said that the difference is not due merely to the laws of probability, and therefore it is assumed that the difference was caused by the effect of the remedy.

Decision as to the value of P which shall constitute significance depends on the circumstances surrounding an experiment, and the degree of confidence required to accept evidence as valid. Normally it is considered safe to say that if an event could occur due to chance less than once in one hundred times ($P = \text{less than } 0.01$), we do not happen to be faced with that one chance occurrence. In other words, the results are due to a factor other than chance, presumably that factor which is specifically under consideration.

Sometimes it is not necessary to be as stringent as this, and once in twenty trials ($P = \text{less than } 0.05$) may be considered sufficiently rare to rule out chance. On the other hand, if the matter is concerned with far-reaching implications, such as lethal dosages for example, confidence may require that chance probability be reduced to one in one thousand or even one in ten thousand ($P = \text{less than } 0.0001$).

For quick estimates, therefore, it is sufficient to remember three of the figures of table 1, thus avoiding the necessity of keeping this table at hand. These are:

x/σ	P (approximate)
2.0	0.05
2.5	0.01
3.0	0.003

When $x/\sigma = 2.0$, the probability of this being due to chance is one in twenty. When $x/\sigma = 2.5$, the probability is one in one hundred. And when $x/\sigma = 3.0$, the probability is less than three in one thousand, or actually about one in four hundred. This may further be reduced to the simple rule that if x/σ is less than 2.0, the difference is not significant; if x/σ is greater than 2.5, the difference is significant; and if x/σ is between 2.0 and 2.5 it is a question of how much assurance is needed to be satisfied that the difference was not due to chance alone.

LIMITATIONS OF THE SIGNIFICANCE TEST

In applying a significance test, a few simple rules must be observed.

1. Each of the internal numbers in the four-part table (the internal numbers in example I are 35, 20, 30 and 32) should be greater than five, and preferably greater than ten. When the x/σ value is in or near the doubtful range, i.e., in the neighborhood of 2.0 or 2.5, this is especially important. When small numbers are involved, a significance test requires a refinement of the foregoing procedure. Under those circumstances the P arrived at as described here is not entirely accurate.

2. The two groups, A and B, must not only be comparable, but also independent. This means, for example, that whether a person is placed in A or in B must not depend on whether he is likely to recover or not, since the factor of recovery is being tested against pure chance.

If these conditions do not apply, a significance test involves a more complex procedure. This may be merely a modification of the formula used here, or it may consist of a radically different approach, which will not be discussed at present.

Aside from these statistical rules, it is most important to consider carefully the exact wording of the conclusions drawn in examples I and II. A significance test consists only of determining what could happen due to chance alone and of showing how the observed data fit into such a possibility. Research workers too frequently are guilty of burdening a significance test with implications as to causation, degree of effectiveness, and so on. The tests in the examples cited here are based on the premise that the cause of the difference was determined on purely logical grounds, rational deductions, and other empirical evidence.

The tests also say nothing regarding the degree of effectiveness of the remedy. Example II may be interpreted as indicating that the remedy will increase recovery by 11 percent. Example I

showed an increase of 15 percent, but this was not significant. To form an opinion as to degree of effectiveness would require a series of experiments, all showing significant differences, and observations of the extent to which these differences vary.

The value of research in medicine depends on the ability of the research worker. He bases his deductions on what he sees and on his reasoning power. Statistical treatment does not add value to his observations. Statistics rarely constitute proof in themselves; they are merely a tool whereby the observer interprets his data. An understanding of the significance test will enable the analyst to see more clearly what his observations mean, but his conclusions are his own responsibility. He formulates laws according to his own observations, based on careful reasoning and good evidence.

Research reports sometimes give a detailed description of the statistical treatment used. And on occasion one receives the impression that such a description is included in order to impress the reader with the high quality of the experimental procedure. This has no place in an analytical report, any more than does a description of the technic employed in bending glass tubing. There is, however, the unfortunate circumstance that proper statistical analysis is not yet sufficiently universal to permit one to assume that it was employed when there is no indication to that effect.

Furthermore, medical statistics being a science which is still in the developmental stage, opinions as to the proper technic are far from uniform. For this reason an excellent suggestion has been made, namely, that when the nature of the conclusions depends to a large extent on the statistical analysis, this analysis be appended to a report for the benefit of those who wish to have it, but so that it will not detract from the value of the description for those who are not equipped to follow such an exposition.

Such treatment of a statistical analysis follows logically when it is remembered that, in medical research, statistics is an implement used in interpreting observations, and not a demonstration of results in itself.

The most commonly used textbooks on medical statistics, including those from which the material of table 1 has been drawn, are listed here in the order in which the writer feels they would be the most useful to the average medical research worker.

BIBLIOGRAPHY

1. HILL, A. B.: Principles of Medical Statistics. 3d edition. The Lancet, Ltd., London, 1942.

2. TRELOAR, A. E.: Elements of Statistical Reasoning. John Wiley & Sons, Inc., New York, 1939.
3. PETERS, C. C., and VAN VOORHIS, W. R.: Statistical Procedures and their Mathematical Bases. McGraw-Hill Book Co., Inc., New York, 1940.
4. SNEDECOR, G. W.: Statistical Methods. The Iowa State College Press, Ames, Iowa, 1940.
5. GOULDEN, C. H.: Methods of Statistical Analysis. John Wiley & Sons, Inc., New York, 1939.
6. PEARL, R.: Medical Biometry and Statistics. 3d edition. W. B. Saunders Co., Philadelphia, 1940.
7. FISHER, R. A.: Statistical Methods for Research Workers. 8th edition. Oliver & Boyd, Ltd., Edinburgh, 1942.
8. YULE, G. U.: Introduction to the Theory of Statistics. 12th edition. J. B. Lippincott Co., Philadelphia, 1940.
9. CROXTON, F. E., and COWDEN, D. J.: Applied General Statistics, Prentice-Hall, Inc., New York, 1942.



ANTITYPHUS SERUM

Antityphus serum has been prepared by injecting horses with living rickettsiae contained in the intestines of infected lice. The serum was given to every second patient in a series of 440 consecutive typhus patients during 18 months in Addis Ababa. The mortality of the treated group was 3.6 percent compared with 10.9 percent in the controls. The serum seemed to shorten the illness and reduce the incidence of psychotic symptoms. Its influence was far greater when given early in the illness.—WOLMAN, M.: Treatment of typhus with antityphus horse serum. *Lancet* 2: 210-212, August 12, 1944.



SULFANILAMIDE INTERFERENCE IN SUGAR URINALYSES

Sulfanilamide, at levels occurring in urine of patients on therapy with this drug, causes low readings in certain qualitative urine sugar methods.

Some quantitative sugar methods give low results also when sulfanilamide is present.

Sulfathiazole has little effect on qualitative urine sugar methods but causes large errors in certain quantitative procedures. The direction of error is opposite to that caused by sulfanilamide.

In general other sulfa drugs are found in urine at levels low enough to offer little or no interference.—TODD, W. R.; DODSON, M. D.; TRAINER, J. B.; and MCKEE, J.: Sulfa drug interference in sugar determinations. *Arch. Biochem.* 4: 337-341, July 1944.

CLINICAL NOTES

CONGENITAL CHOANAL ATRESIA

GILBERT J. ROBERTS

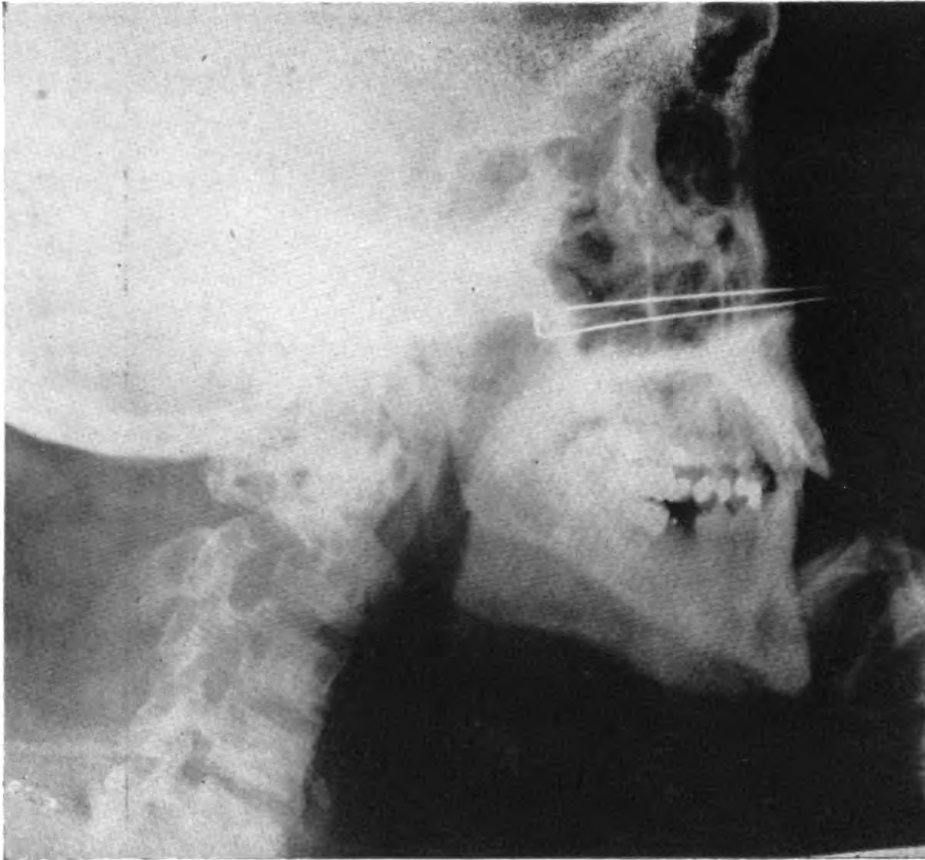
Lieutenant Commander (MC) U.S.N.R.

Congenital atresia or occlusion of the posterior nasal choanae, which at one time was considered a rare anomaly, is apparently not as uncommon as was formerly believed. The first case to appear in the literature was discovered at necropsy and reported by Otto (1) in 1830. A little over a century later Anderson (2) in a comprehensive review of the literature stated that approximately 160 cases had been reported up to that time. A review of the literature for the past 10 years reveals some 50 articles dealing with the subject.

The discovery of such an anomaly in an otherwise normal, healthy hospital corpsman who had passed his physical examination for enlistment in the Navy 9 months previously, prompted this report. This condition is very amenable to surgery in the hands of one accustomed to operating intranasally. A very satisfactory type of local anesthesia by nerve block was employed in the case reported here and it is believed that the operation is made infinitely easier by this procedure. The embryology, anatomy and pathology of this condition have been discussed by Stewart (3), Anderson (2), Kelly (4) Schwartz and Isaacs (5) and others.

Case report.—An 18-year-old hospital corpsman complained that the left side of his nose had been stopped up since infancy. He had been told by his parents that the day after he was born his left nostril was found to be full of a thick jelly-like substance. The attending physician advised his mother to keep the nostril cleaned out with cotton applicators and nothing else was done about it. At the age of 13, because of profuse thick unilateral nasal discharge and severe headaches whenever he had a cold, he was taken to a specialist who attempted to force a probe through the left nasal passage. Following this instrumentation there was considerable bleeding from the left nostril but no blood ran back into the throat, nor were the symptoms relieved.

A short time later the patient's tonsils and adenoids were removed, again without relief of symptoms, and the parents were then told that nothing else could be done until the boy was older. He continued to have a thick mucoid discharge from the left nostril and profuse purulent discharge and headache whenever he had a cold but did not seek further medical attention.



1. Lateral roentgenogram with probes in nasal passages, showing thickness of the bony partition producing atresia.

When he entered the Navy he did not volunteer any information about the condition nor was it discovered upon routine examination.

Examination revealed a well developed youth with a tendency to breathe through his mouth although he did not have the typical adenoid facies. General physical examination revealed no other significant abnormalities. The pharynx was clean. The hearing was normal and both tympanic membranes presented a normal appearance.

Examination of the nose showed the right nasal passage to be clear and no abnormalities were present. The left nasal passage was clear anteriorly but the vestibule and floor were approximately 5 mm. higher than on the right side. There was no septal deviation. The mucosa was pale and the turbinates were turgescient but shrank promptly upon application of a vasoconstrictor. The posterior third of the nasal cavity was filled with a thick tenacious white mucus. This was removed with a suction tip and the posterior end of the nasal passage was seen to be closed.

Probing revealed a bony partition apparently continuous with the posterior border of the septum and the lateral wall and floor of the posterior naris. It was covered with a thin, pale, glistening mucosa which was continuous with the nasal mucosa. Firm pressure with a sharp probe revealed no soft spot which could be perforated. An attempt at forced inspiration and expiration with the right nostril occluded produced no passage of air through the left side.

Posterior rhinoscopy with a postnasal mirror revealed a normal appearing nasopharynx and right choana, but the customary sharp vertical edge of the vomer was replaced by a solid flat wall extending from the midline to the left lateral wall. None of the usual landmarks of the left choana could be seen. An applicator with a short right-angled tip was inserted in the right nasal passage until it entered the nasopharynx. It was then rotated and withdrawn until the tip was firmly against the posterior border of the vomer. A straight applicator was then inserted along the floor of the left nasal passage until it met with firm resistance. The difference in the measurements of the two probes revealed the bony partition to be all of 5 mm. in thickness.

A lateral view x-ray of the skull centered through the posterior border of the septum was taken with the probes in place, revealing the thickness and density of the bony atresia (fig. 1). Routine laboratory examinations of the urine and blood yielded normal results. Bleeding and coagulation times were normal. A blood Kahn test was negative.

The patient was operated upon after premedication with pentobarbital sodium 3 grains, morphine sulfate $\frac{1}{4}$ grain and atropine 1/150 grain. Two-percent procaine with epinephrine was used to block both maxillary nerves and sphenopalatine ganglia in the pterygopalatine fossae via the posterior palatine canals. Three cubic centimeters were injected in each side and an additional 1 cc. submucosally in each side of the nose at the exit of the anterior nasal nerves onto the anterior superior portion of the septum. This maxillary-spheno-palatine block produced a complete anesthesia of the posterior part of the nasal septum, the floor and lateral wall of the nose and the nasopharynx, while the vasoconstrictive effect of the epinephrine produced a most satisfactory reduction in bleeding.

A complete submucous resection was first done, taking care to place the incision well forward and avoiding any tears in the flaps so that a long-bladed nasal speculum could be inserted between the flaps during the later stages. This was relatively simple as the septum was straight and had no spurs. After removing about two-thirds of the vomer bone, additional elevation of the mucosa was necessary. This was carefully done all the way back and laterally along the alae of the vomer which on the left side appeared to extend completely across the choana.

The most posterior part of the vomer was then severed above and below with a small mastoid gouge, taking care to keep the amputation below the level of the sphenoid and the nasopalatine artery and vein. The forward edge of the remaining portion of the vomer was then grasped with a heavy nasal forceps and gently rocked loose. Upon its giving way, the greater portion of the bony partition producing the atresia came with it (fig. 2). All that remained to be done was to split the membrane and insert a piece of No. 18 catheter through the perforation into the nasopharynx and secure it in the nostril. The septal flaps were approximated and held in place by a Lynch septum splint instead of packing them.

The anesthesia throughout the procedure was complete and bleeding was minimal. The patient returned to the ward in good condition except for a rather severe headache which developed as the anesthesia began to wear off.

There was a small amount of postnasal oozing for the first 12 hours and an intermittent headache which was controlled by codeine. The splints and rubber tube were removed at the end of 24 hours and the nares were sprayed with 1-percent ephedrine in saline. The patient could then breathe freely through either nostril but was not allowed to blow the nose. Post-operative



2. Specimen of bone consisting of the posterior portion of the vomer with its lateral extension producing the atresia. Note groove (lower left) for palatal ridge, and smooth surface (above) for junction with sphenoid.

care consisted in daily cleansing and shrinking followed by insufflation with sulfathiazole powder.

In two weeks the patient could breathe freely and blow the nose normally through either nostril. Examination with a postnasal mirror revealed a left choanal opening slightly smaller than the right, with some granulation tissue and crusting around the edges. The posterior ends of the turbinates could be visualized through the opening after the crusts had been removed.

The patient can now breathe more freely through the left nostril than the right, is not bothered with nasal congestion or discharge, and he no longer snores at night.

REFERENCES

1. OTTO, A. W.: Lehrbuch der pathologischen Anatomie des Menschen und der Thiere. A. Rucher, Berlin, 1830.
2. ANDERSON, C. M.: Congenital occlusion of choana. *J.A.M.A.* 109: 1788-1792, November 27, 1937.
3. STEWART, J. P.: Congenital atresia of posterior nares. *Arch. Otolaryng.* 13: 570-583, April 1931.
4. KELLY, D. B.: Congenital occlusion of posterior nasal choanae. *Brit. M. J.* 1: 157-158, January 28, 1939.
5. SCHWARTZ, A. A., and ISAACS, H. J.: Congenital atresia of posterior nares; report of 2 cases. *Arch. Otolaryng.* 35: 603-612, April, 1942.

PERIARTERITIS NODOSA

REPORT OF A CASE

CHARLES M. THOMPSON

Lieutenant Commander (MC) U.S.N.R.

The tendency to regard periarteritis nodosa as a rare pathologic lesion is losing ground (1). The confusion that exists regarding its proper place in clinical medicine may be the result of its protean symptomatology and its integration with other disease entities. There seems to be some relationship between a group of disorders characterized by peculiar lesions of small arteries; these include periarteritis nodosa, lupus erythematosus disseminata, and Libman-Sacks disease (2) (3).

Grouping of periarteritis and other disorders, while not conclusive, is pointing the way to comparisons with other unusual infections. Reimann and his associates (4) recently described the typical lesions and clinical picture of periarteritis in two cases of trichinosis and suggested that this might represent an important relationship. There are marked resemblances in such a group and it may be that in the future they will be more completely integrated.

The vascular lesion in periarteritis nodosa is an acute inflammation and degeneration within the small arteries, followed by infiltration of leukocytes, thrombosis, infarction, and perivascular fibrosis (5) (6). This lesion is more typical than are the clinical manifestations and results. These are often bizarre, and reveal the disease's power of mimicry; this may be greater than that of syphilis.

Diagnosis is often difficult. An unusual symptom complex with fever and leukocytosis should suggest the possibility of this disease. Descriptions of abdominal signs, renal complications, and arthritic and dermatologic features abound in the literature. The patient with few or none of these regional symptoms offers the greatest problem.

Eosinophilia is an objective finding in about 15 percent of cases of periarteritis nodosa (7). Many diagnoses during life have been through incidental biopsies done because of suspected trichinosis. Eosinophilia was the basis for this suspicion. Eosinophils in periarteritis nodosa have been reported as high as 77 percent in the circulating blood (8). Eosinophilia is a significant finding in a case presenting unusual symptom complexes.

In 1936 Löffler described a series of cases with transitory lung infiltrations, fever, acute respiratory symptoms and eosinophilia. Since this observation others have reported evanescent lung pathosis with eosinophilia (9) (10). Bass (11) reported a peculiar syndrome in children characterized by marked leukocytosis, eosinophilia and adenopathy. Polymorphous skin lesions, lung infiltrations with miliary distribution, bronchial spasm, cough, and complete physical debility were present. Myeloid hyperplasia of the bone marrow was found in some of these cases. All the children recovered, and with regression of symptoms the blood picture again became normal.

Punch and Close (12) described the case of a 37-year-old man who suddenly developed dyspnea and cyanosis. The white blood cell count was 20,000 with 53 percent eosinophils. The patient had a cough and pain in the chest of a catastrophic nature. These symptoms moderated, but the patient died one month later of right-sided hemiplegia. No necropsy was reported.

Harkavy (5) reported eight cases resembling those of Löffler in that they all had transitory lung lesions. Other symptoms included polymorphous skin eruptions, bronchial spasm, cough, and fever. Myocardial degeneration and fibrosis were findings. All of his cases showed a polyserositis, involving the pleura in three cases, the pleura and pericardium in two, and the peritoneum in three. Periarteritis was described as a finding in the later stages of one case.

Examination of these reports reveals certain resemblances and raises some questions. If these groups have certain symptoms and objective findings in common, are they properly integrated and is there a common causative background, or should the vascular lesion of periarteritis be considered germane to a number of otherwise unrelated diseases? Harkavy considers allergy to be a causative factor in periarteritis and theorizes that the small blood vessels are the shock tissue. Periarteritis nodosa, a disease entity or a pathologic pattern in a more universal disease complex, could be the end-result.

Case report.—In April 1941, a 42-year-old Naval officer had an attack of acute tonsillitis which responded readily to aspirin and hot gargles. In May he noticed mild pain in the upper right quadrant of the abdomen. The pain occurred at night and was relieved by enema. In November an x-ray examination of the gallbladder revealed numerous radiolucent calculi.

A decision regarding operation had not been made when the Japanese struck. In the urgency of the situation, the patient went to sea. There was an amelioration of symptoms for a while but on 28 February 1942, while at sea, he was admitted to the sickbay with acute cholecystitis. Pain in the upper right abdominal quadrant was severe and tenderness was acute. There

was an elevation of temperature but no nausea or vomiting and no clinical icterus. Pain was still present and the tenderness had increased the next day, and there was a peculiar drowsiness independent of narcosis. The patient's temperature was 102° F., the pulse rate about 120, and the respirations normal. The white blood cell count was 26,000 with 1 percent band cells, 90 percent segmented cells, 6 percent lymphocytes, and 3 percent monocytes.

During a period of 18 days' shipboard hospitalization the patient had marked toxemia. Repeated blood counts showed declining levels with relative polynucleosis. The cells were of the mature type.

One gram of sulfathiazole was given but was discontinued after 24 hours. Parenteral fluids and morphine completed the treatment. The acute symptoms subsided and after 4 days of normal temperature, the patient was discharged to duty on 17 March.

On 2 April the patient was transferred to the Naval Hospital, Pearl Harbor. At this time the liver edge was palpable one finger's breadth below the costal margin; it was smooth and slightly tender. The gallbladder and spleen were not felt. There was no fever and no clinical icterus. The patient had no subjective complaints.

Serum proteins were reported as 4.5 mg. percent. The icterus index was 8. The urine was normal. The blood count was unrevealing; platelets, bleeding time, coagulation time, and prothrombin time were normal. The blood Kahn test was negative. Analysis of the serum protein content showed total proteins 4.6; albumin 3.6; and globulin 1. Routine liver function tests yielded normal results. Stool examinations for ova and parasites were negative. There was no edema.

It was thought that the patient had a complicating hepatitis and he was prepared for surgery by attempting to increase his hepatic reserve. Vitamins including K, parenteral dextrose, special high carbohydrate, high protein-low fat diet, and plasma infusions were given.

After 10 days the liver edge was no longer palpable and the serum proteins were 6.2 mg. percent. The preoperative period was extended to 16 days. Two days before operation the white blood cell count was 11,250 with 2 percent eosinophils; the cells were of the mature type.

Cholecystectomy was performed on 17 April. The gallbladder was thickened and contracted and contained numerous small calculi. Because there were numerous adhesions, separation from the liver was difficult and the gallbladder was torn. Bile soilage resulted. About 8 gm. of sulfanilamide powder was placed in the wound. No abnormality of the liver or other viscus was noted. The microscopic diagnosis was chronic cholecystitis.

There was marked cyanosis and evidence of peripheral circulatory failure in the first 12 hours following operation. Supportive measures included heat, oxygen, dextrose, and 750 cc. of plasma and saline infusions. He rallied from this short critical period and the later postoperative course was without incident. There was no fever and no jaundice. The day following operation the blood sulfanilamide level was 14 mg. percent and the cyanosis was explained on the basis of absorption of this drug into the circulation. Two days after operation the blood count was assuming a more normal picture. The patient was discharged to duty on 27 May.

On 6 June, while at sea, he developed severe generalized pruritus. His temperature was 103.5° F. There was no clinical icterus. The abdomen was without objective signs and the blood count insignificant except for a slight eosinophilic rise. On 9 June, the respirations suddenly became rapid and

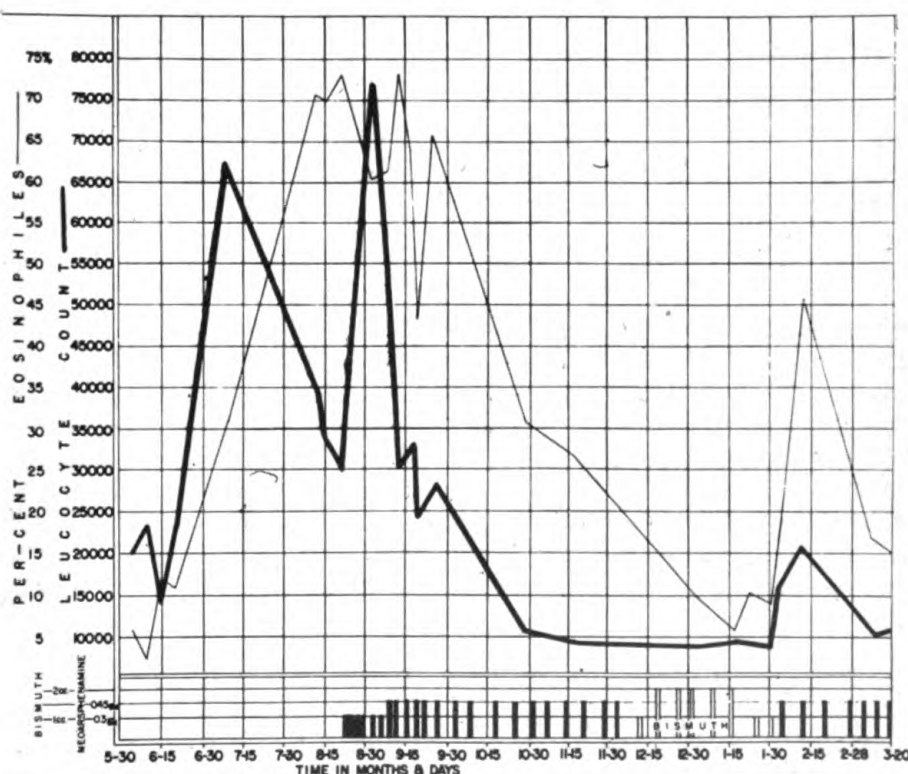
expiratory, and the patient had an intractable cough. Shock ensued and he became cyanotic. Crackling and bubbling râles were noted at the base of the right lung. On oxygen and morphine therapy he rallied and coughed up a thick, bloody plug of sputum.

An unspecified amount of sulfathiazole was given during this phase and on 14 June the temperature, the pulse rate, and the respirations were almost normal but there was severe generalized itching of the skin. The patient complained of pain in the lower right side of the chest and a feeling of numbness in the end of the little finger of the right hand. The next day the fingers of both hands were numb but there was no motor weakness. There were no objective skin lesions, but the itching was worse. The eosinophil count rose to 30 percent. At this time sulfathiazole was discontinued.

On 19 June the patient was transferred from his ship to the Naval Air Station at Kodiak, Alaska. On this admission there were large bullous lesions, hemorrhagic in nature, on the finger tips and large violaceous-appearing lesions in the axillae, between the scapulae and on the buttocks. Small papular lesions were scattered over the abdomen and back. The patient appeared critically ill and did not respond well to questions. Physical signs of an unresolved consolidation in the right lung were confirmed by x-ray examination.

On 20 June the temperature rose to 103° F., followed by extreme diaphoresis. X-ray examination showed increased consolidation in the right lung. The patient was very weak and itching of the skin was severe.

The next day the patient's condition had returned to the usual chronic one in which the main symptoms were weakness, anorexia, pruritus, cough, nausea, and myalgia. The sputum contained numerous organisms, chiefly gram-positive diplococci. After 5 days of a relatively stormy course, check



Relationship of drug therapy to leukocyte count and percent eosinophils.

x-rays revealed a partial resolution of the abnormal density in the right lower lobe.

His improvement was slow and after several weeks he was transferred to the Naval Hospital, Pearl Harbor, arriving in August. Examination at this time revealed extreme cachexia and pallor, and multiple, scattered polymorphous skin lesions including macules, papules, hemorrhagic bullae and small lentil-size subcutaneous nodules. There also was secondary infection and crusting from scratching. The liver and spleen were enlarged and ascites was present. The liver extended halfway from the xiphoid to the umbilicus. The spleen was smooth and tender and extended 2 fingers' breadth below the rib margin. There were diminished breath sounds and medium râles in a small area posteriorly at the base of the right lung. The heart was moderately enlarged to percussion in all areas and the first heart sound at the apex was flapping and of poor quality. There was a presystolic roughening. The eosinophil count was 71 percent.

During the first 10 days of hospitalization the patient was critically ill. The sedimentation rate was 29 mm. in 1 hour; blood sugar 110; blood chlorides 528; blood urea nitrogen 16.1; calcium 8.6; phosphorus 3.6; icterus index 4; van den Bergh test, direct negative and indirect, less than 0.3 mg. The blood Kahn test was negative and all blood cultures were sterile. Total serum protein was 6.38 mg. percent, albumin 2.55 and globulin 3.38. The blood platelet count was 270,000. The prothrombin time was normal. The urine was normal. Hippuric acid excretion was normal as were other liver function tests.

About 1,000 cc. of clear, yellowish fluid was removed from the abdomen and showed a specific gravity of 1.012, total protein 2 gm. percent, and total leukocytes 5,100. On Wright's stain many eosinophils, few neutrophils, lymphocytes, basophils, and monocytes, and no malignant cells were shown. It was negative for tubercle bacilli. No organisms were revealed on Gram's stain and culture was negative.

Skin scrapings of the interdigital lesions were negative for yeasts and fungi. Stools were negative for ova and parasites. A skin test with trichina antigen 1: 8,000 was negative. Uric acid was 5.08.

X-ray examination of the chest showed an infiltration which was considered of inflammatory or neoplastic nature in the lower right lung.

Sternal biopsy on 19 August was of interest particularly because of the eosinophilic findings. It showed:

	<i>Percent</i>
Myeloblasts	6.50
Premyelocytic eosinophils	3.25
Myelocytic eosinophils	13.50
Metamyelocytic eosinophils, band and segmented forms.....	23.50
Premyelocytic neutrophils	1.00
Myelocytic neutrophils	1.50
Metamyelocytic neutrophils, band and segmented forms.....	20.00
Basophilic myelocytes	0.50
Lymphocytes	3.25
Plasma cells	0.75
Erythroblasts, types 1, 2, and 3.....	25.25
Megaloblasts	0.25
Megakaryocytes	0.50
Monocytes	0.25
Total	100.00

There was a distinct proliferative activity of the myeloblasts and pre-formers of the eosinophils. Numbers of mitotic figures were found in the eosinophil premyelocytes and in an occasional eosinophilic myelocyte. Although examination of this specimen suggested eosinophilic myelosis, it was also considered that the proliferative activity of the marrow might be due to other causes. Later a biopsy on a specimen from the sartorius muscle showed changes consistent with those of periarteritis nodosa.

Neoarsphenamine intravenously and bismuth were then included in the therapy, with a slow but progressive improvement in the patient's condition.

On 1 December the liver edge was barely palpable. The spleen descended 1 finger's breadth below the costal margin on inspiration and was not tender. There was no free fluid in the peritoneal cavity, the skin was normal, the lungs were clear, and the heart had a normal rhythm. The pulse rate was 80. There was a late diastolic murmur at the apex, not transmitted, and a soft systolic blow. The blood pressure was 110/70. X-ray examination of the barium-filled esophagus showed enlargement of the left auricle. The heart's response to exercise was satisfactory. The course of the patient's illness may be seen in the accompanying graph. There was a slight recurrence in January 1943, and in February and March the patient showed marked clinical improvement.

COMMENT

It is too early to attempt a prognosis in this case. During the spring and summer of 1943, this patient remained free from clinical symptoms.

Objectively the patient continued to have a systolic murmur at the apex and a short presystolic blow. There was no evidence of general cardiac enlargement and he showed a normal response to the usual cardiac efficiency tests. Due to his value to the Navy as a Japanese language expert he appeared before an examining board in July 1943 and was returned to duty. He continues to carry on his special work in the most arduous manner.

This case has little in common with the usual description of periarteritis nodosa. It was necessary to ignore most descriptions of the disease to recognize the problem before us.

The recorded pathologic findings of periarteritis nodosa in this case were largely confined to the skin and muscle biopsies. The unusual result of a sternal punch biopsy in such a case is unique in so far as can be ascertained. The extreme proliferative activity of the bone marrow, especially of the eosinophilic elements, was a feature in this case. Myeloid hyperplasia of the bone marrow was described in certain atypical disease entities reported by Bass (11). There was nothing about the distribution of white cell elements in his report. Only the maturity of the circulating cell and the small vessel changes kept us from the diagnosis of acute eosinophilic leukemia.

In searching for a clinical designation for a group of diseases with lesions of the smaller arteries, the term visceral angiitis has been suggested (2). This may not be the solution but it is conducive to further investigation of certain diseases which, because of pathologic resemblances, may belong together. This concept encourages study of the bone marrow in cases suggestive of perivascular disease, and biopsy in cases that appear to be atypical leukemias. It may also help to classify a series of cases with anomalous lung infiltrations which have been recently reported (8) (9) (10) (11) (12).

There is as yet no knowledge of the causation of periarteritis nodosa. When one of the theories becomes established as fact, it may be possible to align these diseases in our textbooks and more clearly understand the altered physiology they bring about. Harkavy's (5) work with small vessel changes in allergy, in some features resembling those of periarteritis, may be an important observation. It is conceivable that a hyperergic reaction to infection in small vessels may be the basis of a focal or disseminated arteritis. This would bring into consideration the precursors of the syndrome.

Rich has discussed the role of hypersensitivity in periarteritis nodosa in his experience with seven cases which developed following serum sickness and sulfonamide therapy (13). Again he suggests evidence of hypersensitivity associated with sulfonamide reaction (14). We can only surmise the relationship sensitivity had to sulfonamides in this case. Our experience is too small to generalize on this. However, our study of the sulfonamide reaction must not have a clinical blind spot.

The treatment of periarteritis nodosa is still in the trial and error stage. Neoarsphenamine was used in this case. No attempt is made to credit the patient's improvement to its use, as the disease is conspicuously remittent. Arsenical therapy deserves further trial. Sulfonamides were used during various periods in the patient's illness, but not for his periarteritis. After this diagnosis had been made, these drugs were deliberately avoided. It seemed to us that in view of repeated courses of the drug and without more definite indication their further use was not warranted. We also were dubious as to what an untoward reaction might do to an already damaged physiologic mechanism.

The prognosis in this condition is bad and is not altered by recent improvement. In this disease, as in extirpated malignancy, the patient must have a survival period of more than 5 years before the prognosis can be considered even favorable.

REFERENCES

1. LELOWICH, J., and HUNT, H. D.: Diagnostic significance of eosinophilia in periarteritis nodosa. *Am. J. Clin. Path.* 10: 642-651, September 1940.
2. KRUPP, M. A.: Urinary sediment in visceral angiitis (periarteritis nodosa, lupus erythematosus, Libman-Sacks "disease"); quantitative studies. *Arch. Int. Med.* 71: 54-61, January 1943.
3. BANKS, B. M.: Is there a common denominator in scleroderma, dermatomyositis, disseminated lupus erythematosus, Libman-Sacks syndrome and polyarteritis nodosa? *New England J. Med.* 225: 433-444, September 18, 1941.
4. REIMANN, H. A.; PRICE, A. H.; and HERBUT, P. A.: Trichinosis and periarteritis nodosa; differential diagnosis; possible relationship. *J.A.M.A.* 122: 274-279, May 29, 1943.
5. HASKAVY, J.: Vascular allergy, pathogenesis of bronchial asthma with recurrent pulmonary infiltrations and eosinophilic polyserositis. *Arch. Int. Med.* 67: 709-734, April 1941.
6. KETRON, L. W.: Cutaneous manifestations of periarteritis nodosa. *Arch. Dermat. & Syph.* 40: 929-944, December 1939.
7. HARRIS, A. W.; LYNCH, G. W.; and O'HARE, J. P.: Periarteritis nodosa. *Arch. Int. Med.* 63: 1163-1182, June 1939.
8. ARKIN, A.: Clinical and pathological study of periarteritis nodosa; report of five cases, one histologically healed. *Am. J. Path.* 6: 401-426, July 1930.
9. LÖFFLER, W.: Die flüchtigen Lungeninfiltrate mit Eosinophilie. *Schweiz. med. Wchnschr.* 66: 1069-1078, November 7, 1936.
10. BARKER, C. S.: Transitory lung infiltrations associated with eosinophilia. *Canad. M.A.J.* 40: 494-495, May 1939.
11. BASS, M. H.: Extreme eosinophilia and leucocytosis; unusual clinical syndrome of unknown origin occurring in childhood. *Am. J. Dis. Child.* 62: 68-79, July 1941.
12. PUNCH, A. L., and CLOSE, H. G.: Case of unexplained eosinophilia. *Guy's Hosp. Rep.* 88: 143-149, April 1938.
13. RICH, A. R.: Role of hypersensitivity in periarteritis nodosa as indicated by 7 cases developing during serum sickness and sulfonamide therapy. *Bull. Johns Hopkins Hosp.* 71: 123-140, September 1942.
14. Idem: Additional evidence of role of hypersensitivity in etiology of periarteritis nodosa; another case associated with sulfonamide reaction. *Bull. Johns Hopkins Hosp.* 71: 375-379, December 1942.



TOXIC REACTION TO THIOUREA

Pyrexia of 101°-104° F. occurring 8-10 days after administering thiourea, with palpable enlargement of the spleen, a fall in the white-cell count with monocytosis, and a maculopapular eruption, appears to be due to the thiourea. Three cases were remarkably similar and all symptoms and signs disappeared when the drug was withdrawn, to reappear in one case when it was readministered.—ST. JOHNSTON, C. R.: Toxic reaction to thiourea; report on three cases. *Lancet* 2: 42-43, July 8, 1944.

DAILY USE OF BENZEDRINE SULFATE OVER A PERIOD OF NINE YEARS

REPORT OF A CASE

HENRY J. BAKST
Lieutenant Commander (MC) U.S.N.R.

The literature on the various effects and uses of benzedrine sulfate is extensive. Its action in temporarily delaying the desire for sleep has been well established (1) (2) (3). Associated with this effect there is often an accompanying feeling of augmented energy, relief of fatigue, mental stimulation, and increased confidence (4) (5).

Oral doses of less than 20 mg. appear to have but little effect on the blood pressure (1) (6) (7) (8). While 20 mg. appears to be the minimal pressor dose, with 30 mg. or more the effect on the blood pressure is more certain and usually more pronounced (9) (10) (11) (12) (13) (14) (15). When benzedrine sulfate is administered over long periods, tolerance to the pressor effect is often developed (2) (7) (8) (10) (16) (17). Because of the more striking effect of the drug on the systolic than on the diastolic pressure, the pulse pressure is often increased (2) (8) (12) (18) (19) (20) (21).

The effect of benzedrine on the pulse rate appears to be somewhat variable. Carl and Turner (22) reported an increase in rate averaging 10 beats per minute which persisted for several hours after doses of 10 to 20 mg. Kunstadter (17) noted bradycardia in two cases, and Graybiel and his associates (20) observed a slight increase in the pulse rate after injecting 20 mg. intramuscularly. In general, however, the effects on cardiac action have been negligible (8) (14) (20) (23) (24).

Under certain circumstances large doses of benzedrine seem to be well tolerated. As much as 200 mg. has been given in one day (25) and 160 mg. a day for 3 weeks without untoward effects (7). Although complications have been observed by many investigators, Bloomberg (26) reported negative findings in narcoleptics who had taken 50 to 120 mg. daily for 2½ years.

In view of the suggested tactical and emergency use of benzedrine sulfate it is considered of interest to report the findings on a case which recently came under observation at this Naval air

station. The patient had been taking 15 to 30 mg. of benzedrine sulfate daily for approximately 9 years.

Case report.—A 36-year-old seaman, second class, was inducted on 28 January 1944. On 11 April he was admitted to the sick list for study. His complaints dated back to 1933 when, on one occasion while playing baseball, he experienced a peculiar "blocking" mechanism associated with excitement. He found that he could catch a ball without difficulty, but could not follow through with the necessary throw. Subsequently, during period of stress, although he remained mentally clear and would be fully aware of what he wanted to do, he experienced a sudden loss of the necessary motor control. At times he was aware of an urgent recurrent desire for sleep which would persist for several hours and then disappear spontaneously.

A diagnosis of narcolepsy was made in 1935, and benzedrine sulfate was prescribed. Since that time the patient has been taking 15 to 30 mg. of the drug daily. He stated that after he had begun taking this the urgent desire for sleep during the day did not recur. Lack of muscular coordination during periods of stress, however, persisted. On several occasions while hunting he was overcome by an extreme sense of weakness after firing his gun. This sensation would disappear in a few minutes. On other occasions he found that once he "drew a bead" he could not restrain himself from firing. While at an exciting moving picture he is aware of a marked tremor of his chin and face. The patient's family and past medical histories were essentially unimportant.

The patient was found upon physical examination to be well developed, well nourished, and in no acute distress. An occasional speech defect was present which was characterized by a slight hesitancy followed by mildly explosive speech. At the time of examination there was an extreme tremor of the lower jaw. Examination of the eyes showed the pupils to be equal and regular, reacting well to light and distance. A slight exophthalmos was present with no lid lag. The conjunctivae were clear and there was no nystagmus. The fundi were normal. The heart was not enlarged, its rhythm was regular and sounds were of good quality. No thrills or murmurs were present. The pulse rate was 74 per minute, the blood pressure was 124/74. The biceps, triceps and radioperiosteals, knee and ankle reflexes were generally hyperactive. There was however, no tremor of the extremities and coordination was good. The abdominal and cremasteric muscle reflexes were active. Romberg and Babinski signs were negative.

While under observation on the ward this patient showed no evidence of compulsive sleep characteristic of narcolepsy. Routine laboratory studies of the blood and urine showed no remarkable deviation from normal. The pulse rate averaged 70 beats per minute, and the blood pressure remained at essentially the same level as on admission. The basal metabolic rate on two occasions was minus 26 percent and minus 30 percent. Electrocardiographic findings were completely normal.

After 15 days of observation during which time the patient received no benzedrine and was essentially asymptomatic except for the occasional complaint of insomnia and occipital headache, he was returned to duty. Although it is believed that he will not continue on duty for very long without frequent visits to the sickbay, a trial period of duty was considered worth while. The diagnosis of narcolepsy could not be supported.

SUMMARY

A case of an individual who has been in the habit of taking 15 to 30 mg. of benzedrine sulfate daily over a period of approximately 9 years is reported. No remarkable effects of the long continued usage of the drug could be demonstrated, nor were any perceptible changes noted when the drug was discontinued.

REFERENCES

1. MYERSON, A.: Effect of benzedrine sulfate on mood and fatigue in normal and in neurotic persons. *Arch. Neurol. & Psychiat.* 36: 816-822, October 1936.
2. REIFENSTEIN, E. C., JR., and DAVIDOFF, E.: Benzedrine sulfate therapy; present status. *New York State J. Med.* 39: 42-57, January 1, 1939.
3. BLAKE, H.; GERARD, R. W.; and KLEITMAN, N.: Factors influencing brain potentials during sleep. *J. Neurophysiol.* 2: 48-60, January 1939.
4. BLOOMBERG, W.: Treatment of chronic alcoholism with amphetamine (benzedrine) sulfate. *New England J. Med.* 220: 129-135, January 26, 1939.
5. THORNTON, G. R.; HOLCK, H. G. O.; and SMITH, E. L.: Effect of benzedrine and caffeine upon performance in certain psychomotor tasks. *J. Abnorm. & Social Psychol.* 34: 96-113, January 1939.
6. PEOPLES, S. A., and GUTTMANN, E.: Hypertension produced with benzedrine; its psychological accompaniments. *Lancet* 1: 1107-1109, May 16, 1936.
7. DAVIDOFF, E., and REIFENSTEIN, E. C., JR.: Stimulating action of benzedrine sulfate; comparative study of responses of normal persons and of depressed patients. *J.A.M.A.* 108: 1770-1776, May 22, 1937.
8. ALTSCHULE, M. D., and IGLAUER, A.: Effect of benzedrine (β -phenylisopropylamine sulphate) and paredrine (*p*-hydroxy- α -methyl-phenylethylamine hydrobromide) on circulation, metabolism and respiration in normal man. *J. Clin. Investigation* 19: 497-502, May 1940.
9. ANDERSON, E. W., and SCOTT, W. C. M.: Cardiovascular effects of benzedrine. *Lancet* 2: 1461-1462, December 19, 1936.
10. ULRICH, H.: Narcolepsy and its treatment with benzedrine sulfate. *New England J. Med.* 217: 696-701, October 28, 1937.
11. MATTHEWS, R. A.: Symptomatic treatment of chronic encephalitis with benzedrine sulphate. *Am. J. M. Sc.* 195: 448-452, April 1938.
12. DYER, W. W.: Pressor effect of amphetamine ("benzedrine") on normal, hypotensive, and hypertensive patients. *Am. J. M. Sc.* 197: 103-108, January 1939.
13. GUTTMANN, E., and STOKES, A. B.: Effects of drugs in myotonia. *Lancet* 2: 879-881, October 21, 1939.
14. BEYER, K. H.: Effects of benzedrine sulfate (beta-phenylisopropylamine) on metabolism and cardiovascular system in man. *J. Pharmacol. & Exper. Therap.* 66: 318-325, July 1939.
15. IGLAUER, A., and ALTSCHULE, M. D.: Pressor action of benzedrine and paredrine. *Am. J. M. Sc.* 199: 359-364, March 1940.
16. HILL, J.: Benzedrine in sea-sickness. *Brit. M. J.* 2: 1109-1112, December 4, 1937.

17. KUNSTADTER, R. H.: Experience with benzedrine sulfate in management of obesity in children. *J. Pediat.* 17: 490-501, October 1940.
18. DILL, D. B.; JOHNSON, R. E.; and DALY, C.: Metabolic and cardiovascular effects of intramuscular injections of adrenalin and of amphetamine. *Am. J. M. Sc.* 198: 702-712, November 1939.
19. ERSNER, J. S.: Treatment of obesity due to dietary indiscretion (overeating) with benzedrine sulphate. *Endocrinology* 27: 776-780, November 1940.
20. GRAYBIEL, A.; MICHELSEN, J.; FORBES, W. H.; and BENSON, O. O., JR.: Benzedrine sulphate (amphetamine) and acute anoxia; effects on cardiovascular system. *J. Aviation Med.* 11: 186-193, December 1940.
21. GWYNN, H. B., and YATER, W. M.: Study of temporary use of therapeutic doses of benzedrine sulfate in 147 supposedly normal young men (medical students). *M. Ann. District of Columbia* 6: 356-359, December 1937.
22. CARL, G. P., and TURNER, W. D. Further report on benzedrine sulfate (amphetamine sulfate): Psycho-physical effects and supplementary results from fifth experimental group. *J. Gen. Psychol.* 22: 105-191, January 1940.
23. DAMESHEK, W.; LOMAN, J.; and MYERSON, A.: Human autonomic pharmacology; effect on normal cardiovascular system of acetyl-beta-methylcholine chloride, atropine, prostigmin, benzedrine—with especial reference to electrocardiogram. *Am. J. M. Sc.* 195: 88-103, January 1938.
24. PETERS, C. M., and FAULKNER, J. M.: Circulatory effects of volatile amphetamine (benzedrine inhaler). *Am. J. M. Sc.* 198: 104-107, July 1939.
25. SOLOMON, P.; MITCHELL, R. S.; and PRINTZMETAL, M.: Use of benzedrine sulfate in postencephalitic Parkinson's disease. *J.A.M.A.* 108: 1765-1770, May 22, 1937.
26. BLOOMBERG, W.: End results of use of large doses of amphetamine sulfate over prolonged periods. *New England J. Med.* 222: 946-948, June 6, 1940.



WOUND HEALING WITH POWDERED RED BLOOD CELLS

Dried red blood cell powder was used upon a variety of superficial wounds. The following were noted: (1) The granulating base of a wound takes on a deep beefy red appearance after two or three applications of the powder. (2) Purulent discharge lessens rapidly. (3) Wound healing in most instances is accelerated. (4) Grafts take readily on the healthy granulating base. (5) In one instance, a face wound, the patient complained of mild itching and burning for one or two hours after application of the powder. This disappeared after a few days. (6) It is a very simple, expeditious and economic method of treating many superficial wounds.—SALTZSTEIN, H. C., and KELLY, J.: Wound healing with powdered red blood cells. *North End Clin. Quart., Detroit* 5: 33-35, January-July 1944.

HEMOGLOBINURIA FOLLOWING PLASMOCHIN THERAPY

RICHARD L. THIRLBY
Lieutenant (MC) U.S.N.R.

Two cases of hemoglobinuria complicating malaria treated with plasmochin are here reported. "Blackwater fever" is variously defined, but symptomatically it includes a hemoglobinuria complicating or subsequent to malaria. It is not within the scope of this paper to give an exhaustive discussion of blackwater fever. The two cases here reported, however, fit the commonly accepted definition and are presented because of the disease's rarity in Negroes. Neither of the patients had *Plasmodium falciparum* infection. Both, however, it must be admitted, were receiving plasmochin at the onset of hemoglobinuria.

All of our series of 125 were proved cases verified by positive blood film, and were placed, with individual modifications, on the following program: Quinine hydrochloride, grains 30 daily, was administered until the temperature became normal for 24 hours. This was followed by atabrin dihydrochloride, grains $1\frac{1}{2}$ three times daily, for 5 consecutive days without fever. Antimalarial medication was then discontinued for 2 days, followed by 5 days on plasmochin, 0.02-0.03 gm. daily.

The majority of patients on this regime became afebrile on the fourth day. It was noted that often on the first day of atabrin therapy the temperature would rise to 99° or 99.8° F. It was later found that this could be eliminated by overlapping the last day on quinine and the first day on atabrin. Other than the instances reported here, no serious toxic effects were noted in this series of patients. Vertigo and tinnitus were common while receiving quinine. Mild cyanosis during plasmochin therapy was observed in about 10 percent of the patients, being more common in those patients receiving 0.03 gm. daily than in those receiving 0.02 gm. Occasional mild transitory headache while on plasmochin was also experienced, as was a temperature rise of 99° F. on the second and third days on receiving this drug. No cardiac arrhythmias were observed.

The case histories presented are of patients having the only serious toxic manifestations encountered in our use of plasmochin.

CASE REPORTS

Case 1.—A Negro, age 24 years, was admitted to the hospital with a history of headache, chills, and fever of 24 hours' duration. The past history revealed his having had malaria in Louisiana 8 years before the present illness.

Physical examination was essentially normal except for moderate abdominal tenderness in the right upper quadrant, temperature 99.4° F., pulse 100 and respirations 26. Thick blood film was negative for malaria on the day of admission, but the next day the temperature rose to 101° F. and a thick smear was positive for *Plasmodium malariae*. Quinine, grains 30 daily, was started and the temperature returned to and remained normal. Quinine was discontinued after 3 days and atabrin ordered. However it was later discovered that the patient did not take any atabrin.

After the patient supposedly had had 5 afebrile days on atabrin, 0.3 gm. daily and 2 days without medication, plasmochin 0.01 gm. three times daily for 5 days was begun. This was tolerated well without complaints except for a fever of 99.2° F. on the third and fourth days on plasmochin. A checkup blood smear taken on the fourth day on plasmochin was negative for malaria.

The day after discontinuation of plasmochin, the patient complained of severe frontal headache and a feeling of vague abdominal soreness with nausea. Physical examination showed a temperature of 100.2° F., pulse 100, respirations 20. The patient was jaundiced and there was tenderness in the right and left upper quadrant, the liver and spleen were not felt. A urine sample was port wine-colored, albumin 4 plus, the sediment (uncentrifuged) showed many coarsely granular casts and a few white blood cells. The erythrocyte count was 2,400,000. The patient was put to bed and his hospital course was uneventful except for mild headache and backache. He was given abundant fluids and an adequate urinary output was maintained. The following day the red blood count was 1,400,000 and the urine was unchanged. Five hundred cubic centimeters of citrated blood was given following which the patient had a severe chill and subsequent temperature rise to 103° F. The next day the patient had a loose watery black stool. The temperature was normal and remained so except for an afternoon rise to 99.8° F. 2 days later. A smear taken at the time of the chill was negative for malaria. The urine had cleared to cloudy yellow, but many coarsely granular casts, renal epithelial cells containing hemosiderin granules were seen and albumin, but no red blood cells were present. In 2 days the urine was negative and the red blood count was 2,740,000. The patient was started on ferrous sulfate and approximately 1 month after admission was evacuated to a nonmalarious area.

Case 2.—A Negro, age 20 years, was admitted with a history of chills and fever. The temperature was 104° F., pulse 102, and respirations 24. The skin was hot and dry and the spleen was not palpable. Three blood films were positive for *Plasmodium vivax*. The patient was a native of Florida, where he had been treated for "chills and fever" when he was 8 years old, but he can give no definite history of his having had malaria. He was started on quinine, grains 30 daily, and the temperature returned to normal where it remained until the second day on atabrin. The patient felt well and had no complaints, although he had a daily evening temperature of 99° F. after starting on atabrin. Atabrin was discontinued and plasmochin, 0.01 gm. three times daily, was begun. He tolerated plasmochin well up until the fourth day when he complained of postorbital headache. The temperature was 99.8° F. and pulse 58. The next morning he had pain over the kidney area and the spleen

was palpable and tender. The conjunctivae were icteric. The urine was very dark amber in color, albumin 4 plus, no red blood cells, but many coarsely granular casts and renal epithelial cells containing hemosiderin granules were seen. The red blood count was 3,720,000. A diagnosis of blackwater fever was made and plasmochin was discontinued. A thin blood film was negative for malaria.

The patient continued to complain of backache and vertigo, especially on standing. His temperature ran between 98° and 100° F., no chills or irregularities in cardiac rhythm were noted. Adequate urinary output was maintained. Repeated urinalyses revealed numerous casts, renal epithelial cells, albumin, and no red blood cells. In approximately 3 weeks the temperature had stabilized at normal, the icterus and urine cleared. The erythrocyte count was 2,980,000. The patient, however, still complained of mild vertigo. He was evacuated to a malaria-free area.

DISCUSSION

Neither of these patients was critically ill, nor did either have extremely high fever with chills. However they definitely had "blackwater" which contained 4-plus albumin, many coarsely granular casts, and renal epithelial cells containing hemosiderin granules in an uncentrifuged sediment. Both were icteric and anemic, the red blood count of the first case being 1,400,000 two days after the onset of his hemoglobinuria. Blood films were negative for malaria during the stage of hemoglobinuria.

Case 1 had the onset of hemoglobinuria the morning following the 5-day plasmochin treatment during which he had received a total of 0.15 gm. of this drug. It is noteworthy that this boy did not take atabrin because, as he later said, it made him ill. He gave a definite history of having had malaria in Louisiana 8 years previously, but denied any intervening attacks. In view of the finding of *Plasmodium malariae* it was felt by the malariologists here that this attack was a relapse of his original infection and not a new infection, as primary *Plasmodium malariae* infections in this area are extremely rare.

The second boy developed hemoglobinuria after 4 days on plasmochin during which he received a total of 0.12 gm. of this drug. He gave no definite history of his having had malaria, although he revealed that at the age of 8 years he was treated for chills and fever in Florida. His infection was of the benign tertian type, and as with the other patient, his hospital course was uneventful up until the onset of hemoglobinuria. Although this second patient's urine was not as deep red as the first's, the urinary sediment was similarly loaded with granular casts, renal epithelial cells containing hemosiderin granules, and there was a remarkable absence of red blood cells. His subjective symptoms

were more severe, his chief complaint being vertigo on standing, to the extent that on one occasion he fell while walking across the ward.

SUMMARY

Two cases of hemoglobinuria in Negroes under treatment for malaria are presented. Both were receiving plasmochin when this complication occurred. One hundred twenty-three other cases of malaria have undergone the same therapeutic regime without any serious toxic manifestation. These two cases are of special interest because of their occurrence in Negroes, neither of whom had *P. falciparum* type of infection, and because both were receiving plasmochin. In view of the rarity of blackwater fever in Negroes and in types of malaria other than *P. falciparum*, it is felt that plasmochin very probably precipitated these instances of hemoglobinuria.



URTICARIA FROM POOLED HUMAN PLASMA

A severe reaction of an allergic nature due to elements specifically present in Pool 109 plasma was observed. The elements were antigens from milk, beef and lamb. No allergic reaction to human plasma per se occurred in the patient.

The chance of such reactions will be less if (a) blood donors avoid all food for at least six hours before giving blood, and (b) as many donors as possible contribute to a pool in order to dilute such allergens as might be present in individual instances.—DICKSTEIN, B.: Severe urticarial reaction due to pooled human plasma; report of case. *Ann. Allergy* 2: 327-338, July-August 1944.



EFFECTS OF GELATIN IN WOUNDS

Implantation of both gelatin and the closely related collagen results in their utilization in experimental sutured wounds in such a way that the strength of these wounds is greatly increased over that of untreated control wounds.

Application of gelatin to fresh, open wounds appears to hasten the process of fibroplasia and to produce more rapid, stable healing than occurs in similar wounds not so treated.

Sulfonamide compounds and gelatin possess no chemical or physiologic incompatibility and have therefore been mixed and implanted advantageously in contaminated wounds.—SINCLAIR, J. A., and DOUGLAS, B.: Local implantation of gelatin in wounds. *Arch. Surg.* 49: 47-50, July 1944.

AVULSION OF FOREARM

REPORT OF A CASE

ROBERT F. LEGGE
Commander (MC) U.S.N.R.

The following case is reported in order to call attention to a means of injury which has already been noted, that of the rotary driers used in laundries aboard ships. A case of multiple fractures of arm and forearm from this cause has recently been reported by Shoor.¹

Case report.—A gunner's mate, third class, 19 years old, was attempting to investigate the cause of vibration in a rotary drier in the laundry. He lifted the lid, which automatically turns off the current to the motor, but while the basket was still rotating, placed his right hand on the bottom of the basket. The arm was immediately drawn in and around, resulting in almost a complete avulsion of the forearm at the elbow (fig. 1).

Examination showed the articular surface and distal 2 inches of the humerus presenting in the wound, which encircled the elbow except for a narrow posteromedial flap. All the anterior muscles and tendons were severed. There was ulnar sensation, but no median or radial sensation. The only structure preventing complete avulsion was the triceps muscle.

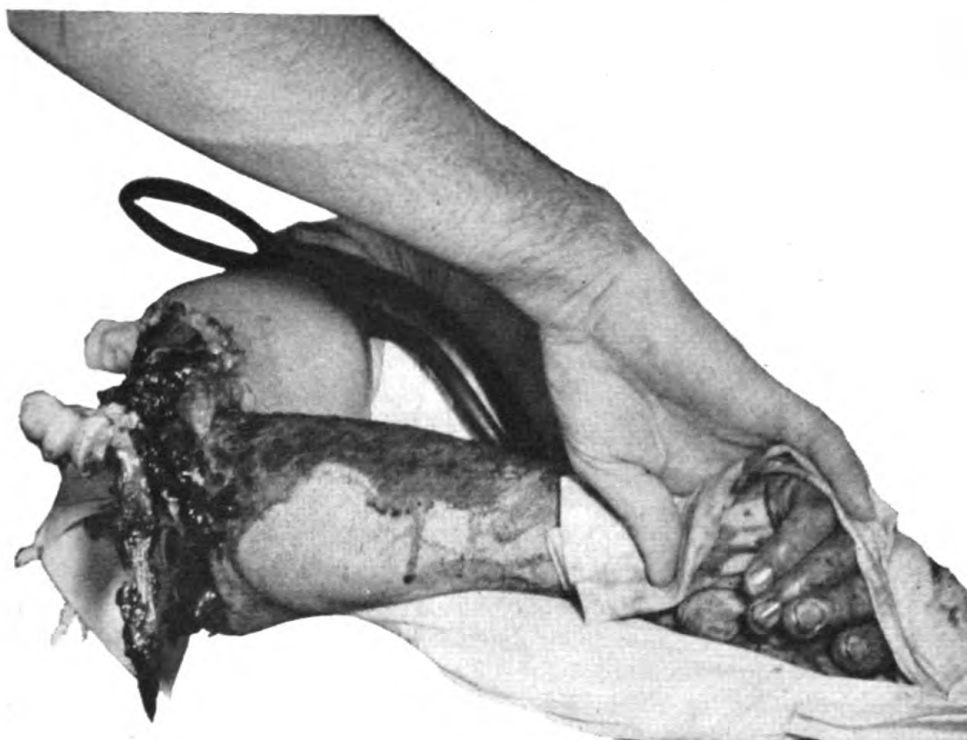
Within 10 minutes after injury, the patient was under ether anesthesia. The brachial artery was tied. The anterior joint capsule was sutured after reduction of the dislocation. The fractured fragments of the head and neck of the radius were excised. The biceps and brachioradialis tendons were sutured, and the skin was closed. A functional arm was never hoped for, but it was hoped that the ulnar collateral artery might provide a sufficient circulation to save the forearm and hand for esthetic value.

Two days later, however, the fingers were gangrenous (fig. 2), so the forearm was amputated, employing a viable posterior forearm flap in order to save all the remaining skin on the anterolateral surface of the arm. Intravenous dextrose with saline, plasma and two transfusions of citrated blood were administered between the first operation and the second day following the amputation. One week postoperatively the patient's temperature was normal and half the skin sutures were removed. On the fourteenth postoperative day he was transferred to a Naval hospital.

CONCLUSIONS

This is the second reported case of severe injury to an arm sustained as the result of contact with the continuing rotation of

¹ SHOOR, M.: Multiple fractures of arm and forearm. U. S. Nav. M. Bull. 42: 693-695, March 1944.



—Official U. S. Navy Photo

1. Immediately following injury and before induction of anesthesia.

While holding the right forearm with his left, and exerting pressure with his left hand around his right arm above the injured site, to control bleeding, he managed to ascend one ladder, walk 125 feet and descend another ladder to the sickbay. A tourniquet was immediately applied to control brisk arterial hemorrhage.



2. Showing attempted repair, and gangrene of fingers.

—Official U. S. Navy Photo

a ship's laundry drier. Although a footbrake is provided for deceleration of the rotating basket, the temptation to use a hand in assisting the act is apparently great. It is recommended that either: (1) The hazard be widely advertised and warning signs be placed near each machine; or (2) a mechanism be devised which would prevent lifting the lid until complete cessation of rotation of the basket.



DEEP BREATHING IN PRESENCE OF THROMBOPHLEBITIS

The most important factor in the mechanism of the return of blood to the heart from the peripheral veins is probably that of respiration. Deep breathing produces a marked increase in the downward gradient of pressure and hence the effect of suction. In the presence of a thrombus which is loosely attached or which has a long tail waving in the lumen of a vein, suction which tends to loosen or to break the thrombus is accompanied by grave danger of pulmonary embolism. It is of the utmost importance, therefore, that whenever thrombophlebitis or phlebothrombosis is suspected or established, deep respiration should be avoided.—News and Comment: Danger of deep breathing in presence of thrombophlebitis or phlebothrombosis. Bull. U. S. Army M. Dept. No. 76: 26, May 1944.



OILED FLOORS AND RESPIRATORY INFECTION

Treatment of wooden floors with spindle oil at regular intervals significantly lowered the rate of respiratory infections in a large military unit as compared with the incidence in a similar control unit, living under comparable conditions, where oiling of floors was not practiced.

In the unit where floors were oiled the average rate of respiratory infections was 7 per 1,000 men, as against 38 per 1,000 men in the control unit. During the 17 weeks of the experiment, from the week ending 5 December, 1942 to that ending 27 March, 1943, no major outbreak of respiratory infection appeared in the test unit; in the control unit an outbreak of almost epidemic proportions prevailed between the middle of February and the first week of March.—ANDERSON, P. H. R.; BUCHANAN, J. A.; and MACPARTLAND, J. J.: Oiled floors to control respiratory infection; Army experiment. Brit. M. J. 1: 616-617, May 6, 1944.

MEDICAL AND SURGICAL DEVICES

CONSTRUCTION OF A CONTACT LENS

FOR LOCALIZATION OF INTRAOCULAR FOREIGN BODIES

WILLIAM P. McGUIRE

Lieutenant Commander (MC) U.S.N.R.

and

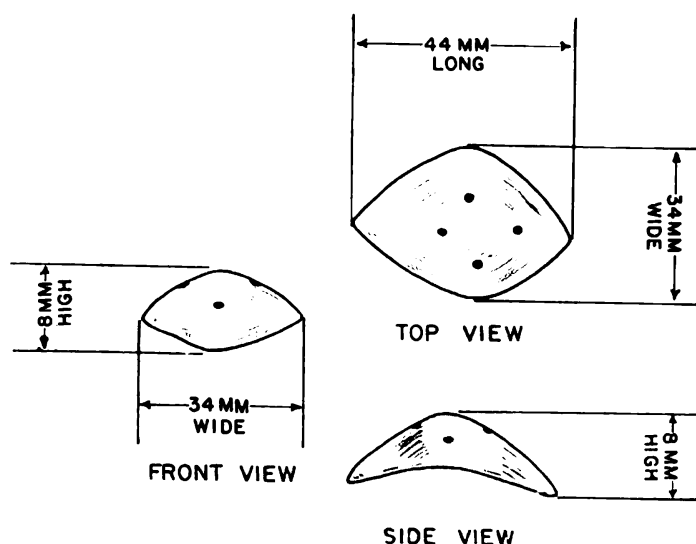
EDWARD C. RAFFETTO

Lieutenant Commander (DC) U.S.N.

An adequate localizer for intraocular foreign bodies will preserve many eyes that otherwise would be lost. The method used at this activity was first described by Comberg in 1927 and since that time has been improved by Pfeiffer. However in time of war it is sometimes difficult, if not impossible, to obtain special equipment. This is particularly true in or near combat zones. By the method to be described, an adequate contact lens localizer for intraocular foreign bodies can be constructed in any activity where there is a dental prosthetic department. This work was carried out aboard a hospital ship, but there is every reason to believe that such construction can be done by many Naval medical facilities at advance bases.

A matrix of dental pink baseplate wax is molded to fit inside the lids and on the scleral portion of the eyeball. This matrix serves both as a lid retractor and as a form for holding the impression material. The material was first tried on the eye of a rabbit without producing any harmful effects upon the cornea or conjunctiva. For the mold a dental impression material was used of an alginate-base powder type which when mixed with water forms an elastic gel. A unit of this consists of approximately 13 gm. of powder and a capsule containing a retarder.

The retarder is first placed in the water and dissolved. The powder is then added and thoroughly spatulated. Water at approximately room temperature (70° F.) is used. For dental impressions the ratio of the mixture is 55 cc. of water to 1 unit of powder. However, for an impression of the eye this ratio resulted in too thick a mixture, and the water ratio was increased to 75 or 80 cc. of water to one unit of powder. The setting time of such a mixture is approximately 4 minutes. During this period the patient, who is



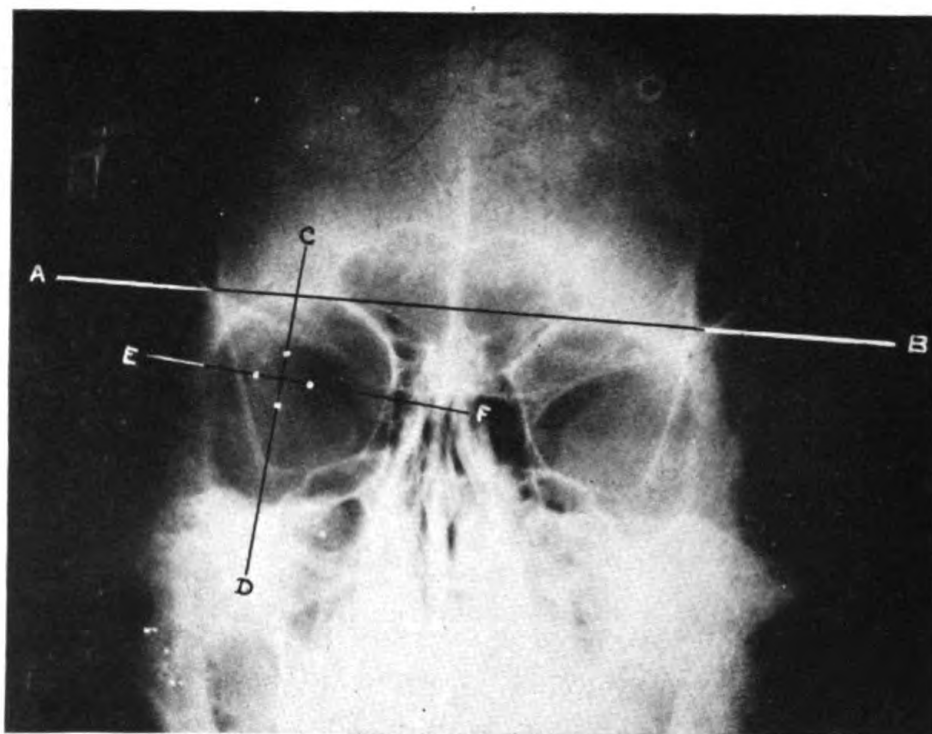
1. Contact lens.

lying on his back with the eyes fixed on a point overhead, must keep his eyes quite steady, but if proper local anesthesia has been instilled this will not prove too difficult.

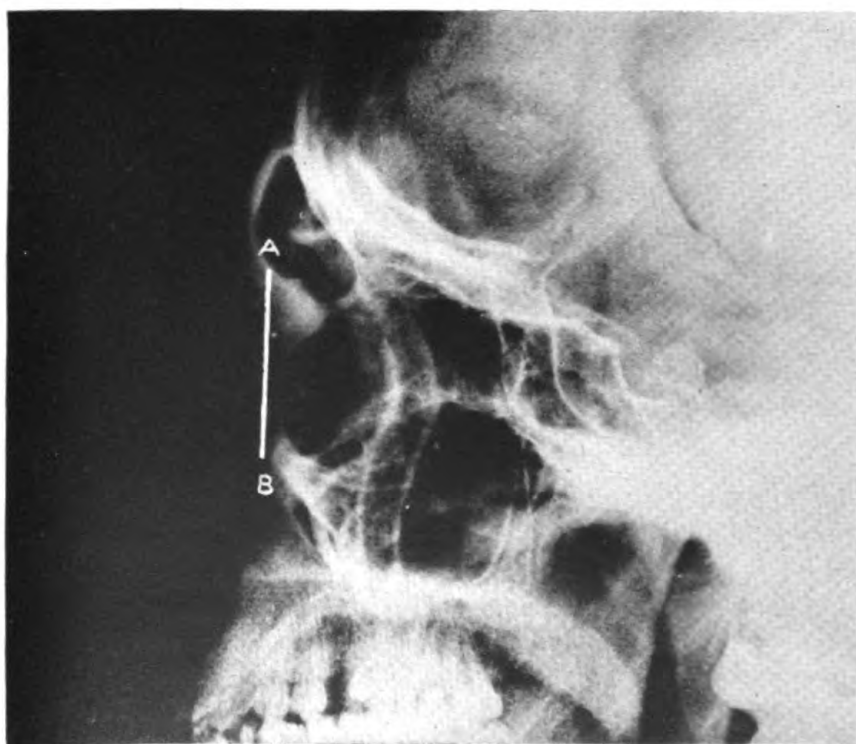
The resulting impression is accurate and shows a definite corneoscleral junction. The impression is washed and immersed in a fixing solution for 5 minutes (powder fixing wafers are supplied with the powder outfit). A stone cast is poured and invested in the lower half of a dental flask. A wax pattern is made and the upper half of the flask poured. The flask is then separated and the stone model encased in tinfoil. The case is then processed with a clear acrylic resin. The lens (fig. 1) is polished and placed in the eye. With the lens in place, the corneoscleral junction clearly showing through the transparent acrylic material, an indelible pencil is used to mark four points on the lens at the corneoscleral junction in the 12, 3, 6, and 9 o'clock positions. Small holes are then drilled in the anterior surface of the contact lens at each of these points and packed with silver amalgam alloy. The polishing of these amalgam "fillings" completes the lens.

A brief review of the technic in localization of foreign bodies by this method should be given. The suspected eye is anesthetized by the instillation of several drops of 2-percent butyn sulfate solution or other local anesthetic. The patient is then directed to look straight ahead. The upper lid is retracted slightly by the hand of the operator while the lower lid may be retracted by the patient himself or by an assistant. The contact lens is then placed in position over the eye and the lids are allowed to resume their normal position.

It is important that when the x-ray views are made, the four



2. Posteroanterior x-ray view.



3. Lateral x-ray view.

amalgam points, which are radiopaque, should lie on the corneo-scleral junction. A slight adjustment of the lens just prior to the exposure may be necessary to effect this. Two views are then made, the first being a straight anteroposterior view with the forehead and tip of the nose touching the plate and the tube angled 30° toward the feet. The second is a true lateral projection through the orbits with the affected eye closest to the film. In both of these projections it is important that the patient should be gazing straight in front of him with the unaffected eye. A current strength of 30 milliamperes at a distance of 30 inches and exposure of $\frac{3}{4}$ second are employed. For the anteroposterior view 75 kv and for the lateral 58 kv are used. It should be noted that our views have been taken with a 60-cycle current and full wave rectification.

In localizing the foreign body on the films the following technic is used. On the anteroposterior view a line is drawn on the film through both superior orbital margins; this furnishes a horizontal base line (fig. 2, A-B). The opposing amalgam points of the contact lens are connected by lines on the film (fig. 2, C-D and E-F). The intersection of these lines determines the center of the cornea. From this intersection a line is drawn to the foreign body, and is extended to join the line between the superior orbital margins.

From these lines the distance the foreign body lies from the center of the cornea, or anterior pole of the eye, can be measured laterally. Also the angle between the horizontal base line and the line connecting the foreign body with the center of the cornea is measured with a protractor. By this means, the exact meridian in which the foreign body lies is determined. The lateral film has only one line drawn on it, a vertical line connecting the two most widely separated amalgam points. This determines the plane of the limbus, and measuring from this, either forward or backward, gives the position of the foreign body with respect to the limbus (fig. 3, A-B).



LIFE-LONG IMMUNITY CONFERRED BY YELLOW FEVER

The belief in a permanent life-long immunity conferred by an attack of yellow fever finds confirmation in all the experimental evidence obtained by the protection tests with monkeys and mice, as illustrated by the author's recent experience which shows that his blood serum, 77 years after a primary attack of yellow fever, is protective and life-saving to mice.—MATAS, R.: Permanent presence of specific immunizing antibodies in blood of yellow fever subjects. New Orleans M. & S. J. 97: 9-13, July 1944.

COMBINATION SHIPBOARD OPERATING TABLE

FOR GENERAL, ORTHOPEDIC AND UROLOGIC SURGERY

ALTON R. HIGGINS
Commander (MC) U.S.N.

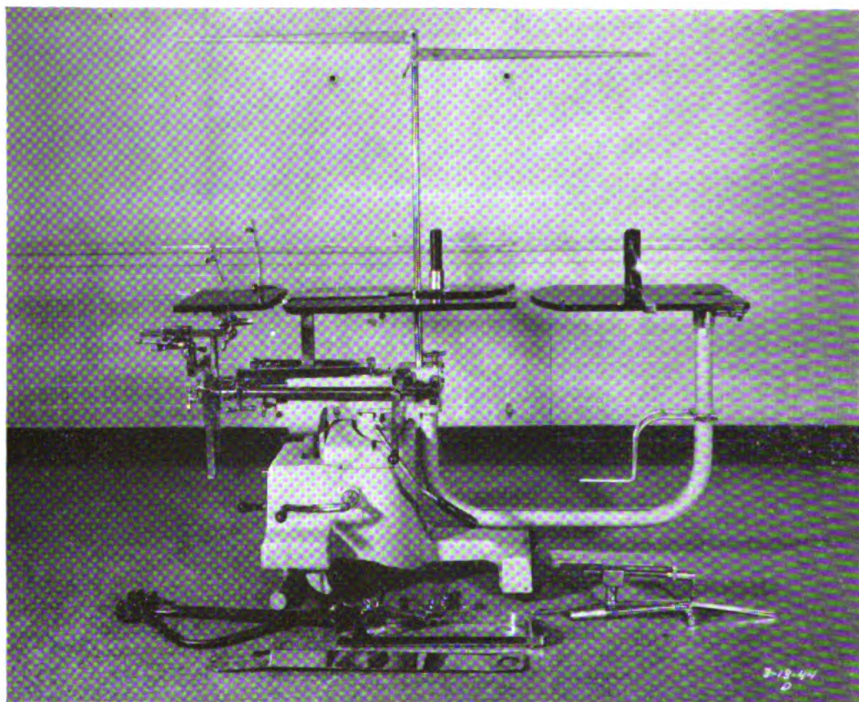
In the eternal compromise aboard ship between the limitation of space and the ideal medical department, there can be no duplication of equipment. The result, in the case of the operating table for shipboard use, is that the major requirement for general surgery is filled by the medium operating table (MSD Catalog Stock No. 3-880), which is provided as standard equipment in shipboard operating rooms. This table is satisfactory for all usual procedures in the field of general surgery, but does not have the functional design for orthopedic or urologic procedures.

In larger ships, both auxiliary and combatant, many individual surgeons have ingeniously modified the standard operating table by various attachments, generally designed to provide traction for fractured long bones. Several commercial attachments have also been developed, making possible to a greater or less degree the reduction of fractures by traction methods.

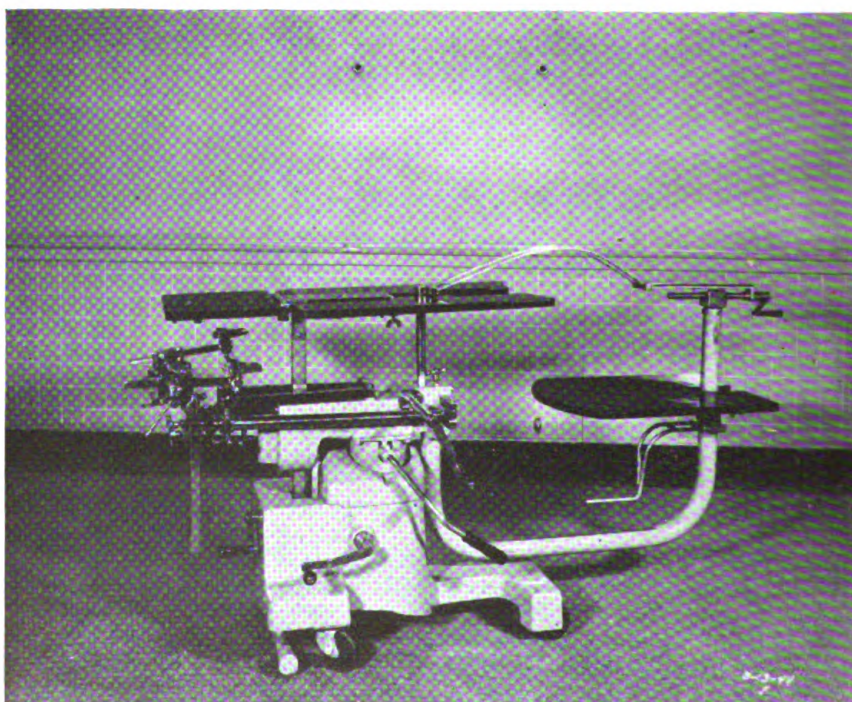
Because of the growing need under war conditions of an operating table which could "double" in the fields of general surgery, orthopedic, and urologic surgery, the problem was discussed with a manufacturer of this type of equipment. It was apparent that previous designs of combination tables had been based on adding attachments to a general surgical table, and a new approach was suggested; that an orthopedic table be modified to suit the requirements of the general surgeon and the urologist.

The device which was developed, and which is shown in the accompanying illustrations (figs. 1 to 12), is simple, relatively inexpensive, and combines satisfactorily all the necessary features of a general operating, orthopedic and urologic table. It should be valuable in ships where the scope of orthopedic work justifies the additional cost.

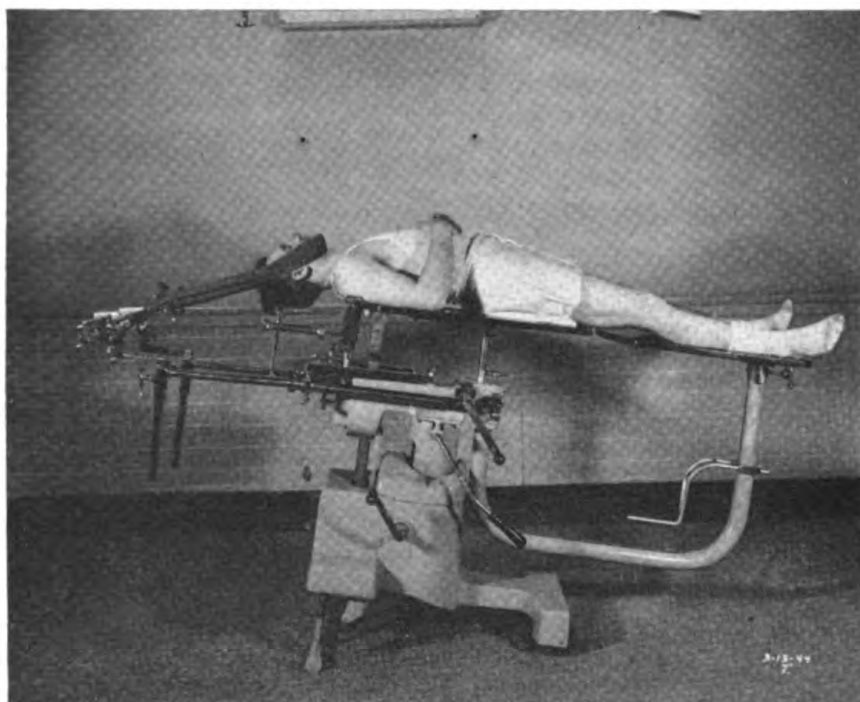
A feature not shown in the accompanying illustrations is the method of mounting the table on the deck. It will be noted that all the features of the standard Albee-Comper table have been retained. Goldthwaite irons have been used for spine positions, and additional rope and pulley extension may be used to the overhead.



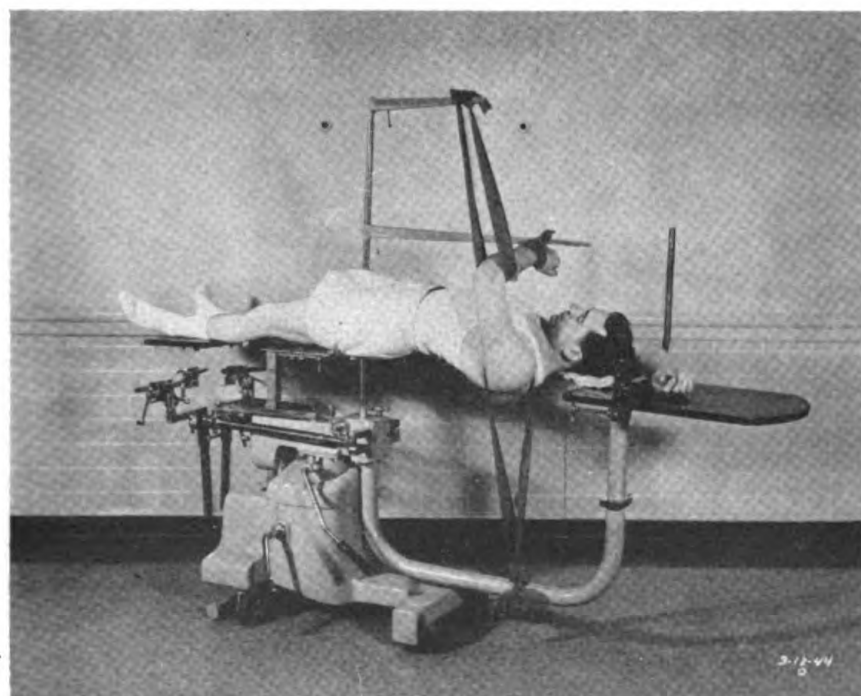
1. The basic table, showing standard Albee-Comper orthopedic table, with overhead suspension and attachments.



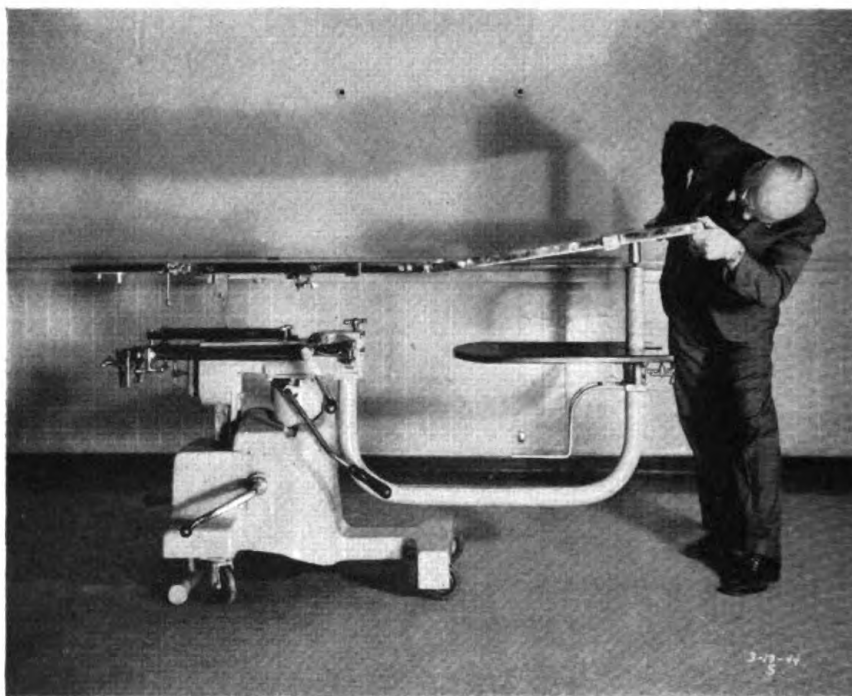
2. Standard Albee-Comper table; Goldthwaite iron in place.



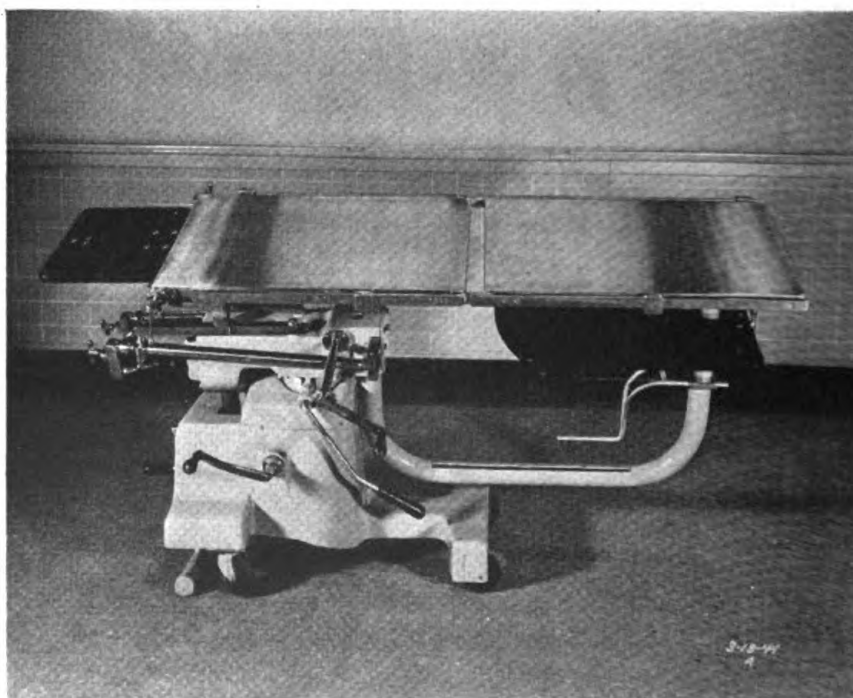
3. Standard Albee-Comper table; head traction and countertraction.



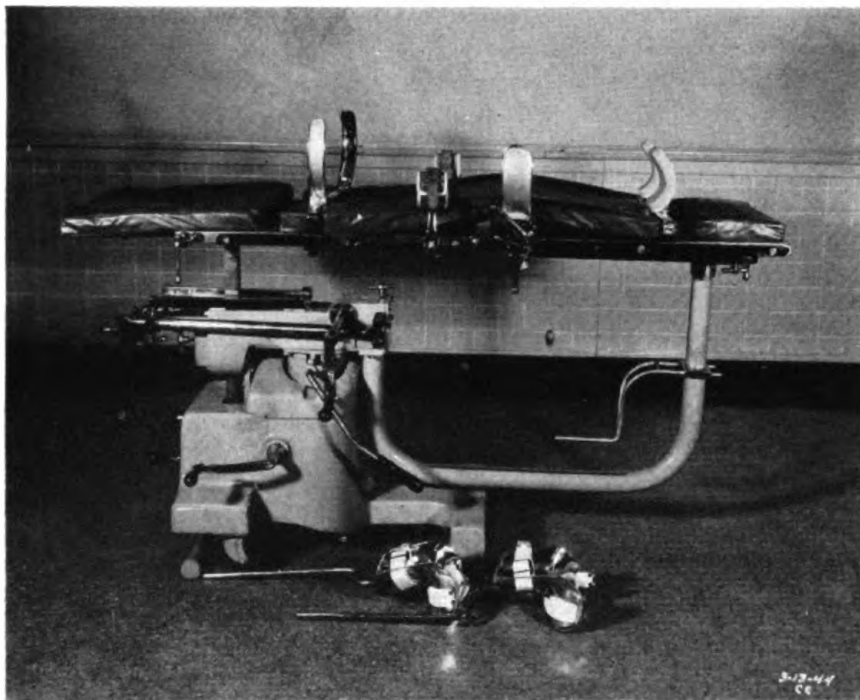
4. Standard Albee-Comper table; overhead traction and countertraction.



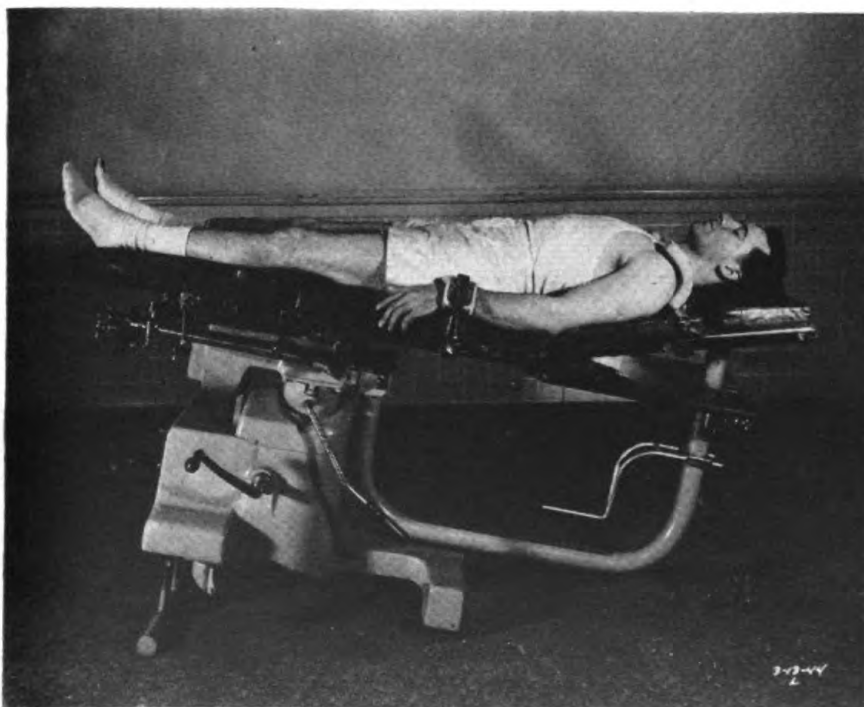
5. Combination table. The top, in two sections, is fitted on the elevating columns.



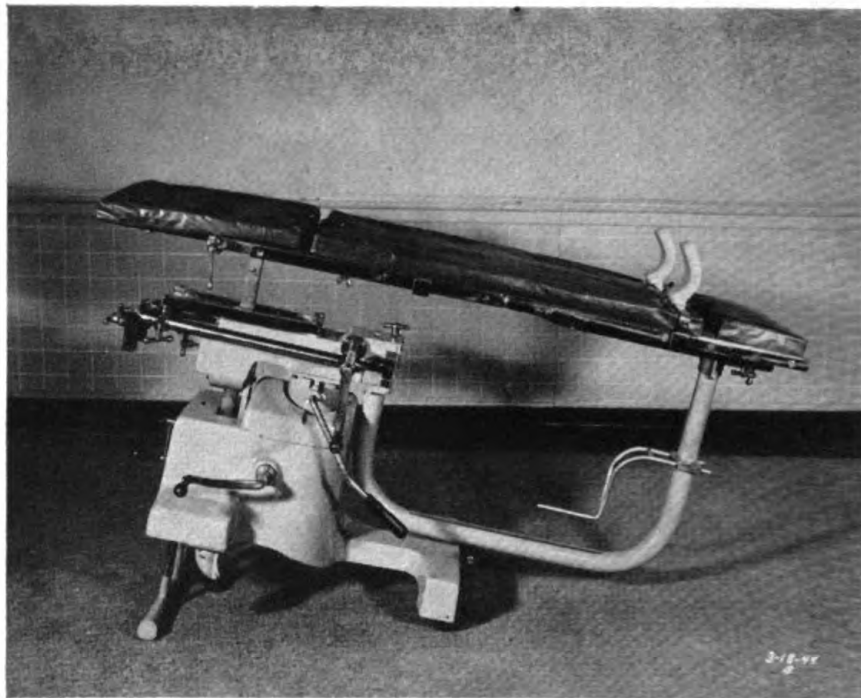
6. Combination table with the sectional top in place.



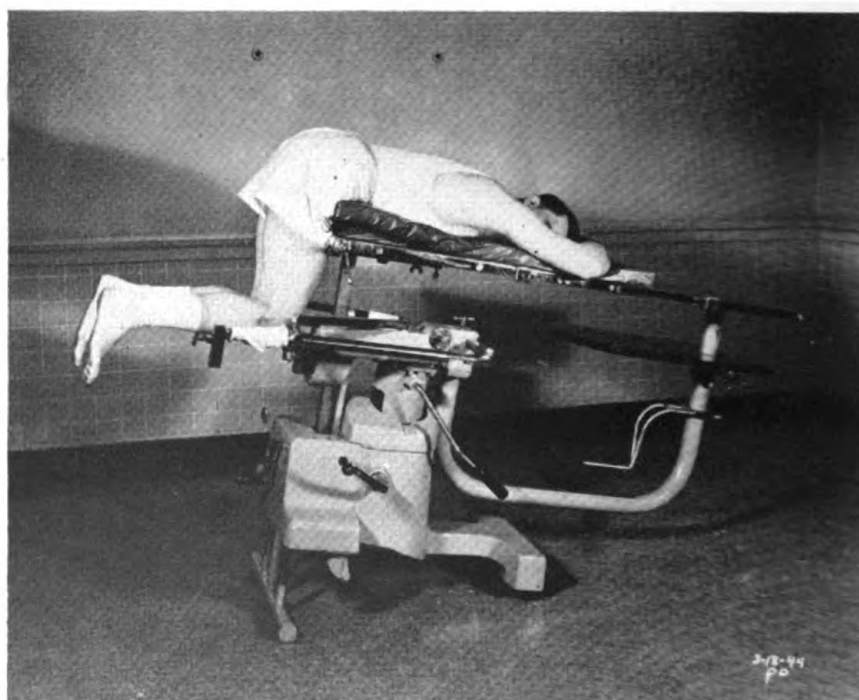
7. Combination table as general surgical table, with attachments.



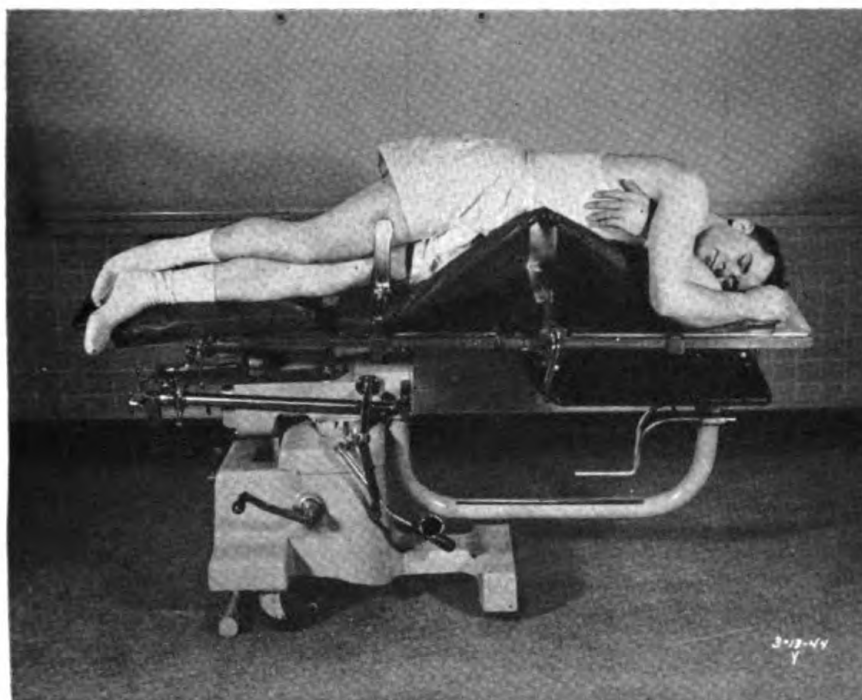
8. Combination table—reflex abdominal position.



9. Combination table—Trendelenburg position.



10. Combination table—proctologic position.



11. Combination table—Mayo kidney position.



12. Combination table—cystoscopic and perineal position.

All usual positions required in general surgery are provided by the only new feature, which is a sectional top, arranged to fit on the elevating columns of the table.

This table is now available for units in which the scope and nature of surgical work requires this functional combination. The sectional table top alone is also available for use where an orthopedic table of the type shown is in place and additional general operating table capacity is required.

Gratitude is expressed to Mr. Adrian Comper of Erie, Pa., for the technical development of this device and for the photographs used.



EFFECTS OF PROCESSING UPON CERTAIN FOODS

Baking of bread involves losses of 20-21 percent of thiamine but does not decrease the amounts of riboflavin. Vegetables lose from 10 to 40 percent of their thiamine during dehydration or canning and an average of 35 percent in cooking. In cooking various types of vegetables, niacin is retained to the extent of 80 to 90 percent if the cooking liquors are included with the solid portions. Storage of dehydrated vegetables apparently does not greatly decrease the thiamine content.

Cereals and legumes ordinarily show little loss of any of the vitamins except during baking or long cooking unless the cooking water is discarded.—RICE, E. E., and ROBINSON, H. E.: Nutritive value of canned and dehydrated meat and meat products. *Am. J. Pub. Health* 34: 587-592, June 1944.



LEVEL OF VITAMIN B-COMPLEX IN THE DIET

A daily dietary intake of approximately 0.20 mg. per 1,000 calories of thiamine (a total daily intake of about 0.6 mg.) results in definite objective and subjective signs and symptoms of a dietary deficiency within 6 weeks. Based on observations and a consideration of the literature, the minimum daily requirement of thiamine of young adult men ranges from 0.33 to 0.45 mg. per 1,000 calories.—FOLTZ, E. E.; BARBORKA, C. J.; and IVY, A. C.: Level of vitamin B-complex in diet at which detectable symptoms of deficiency occur in man. *Gastroenterology* 2: 323-344, May 1944.

IMPROVISED DONOR SET FOR GIVING INDIRECT TRANSFUSIONS

PAUL PETERSON
Commander (MC) U.S.N.

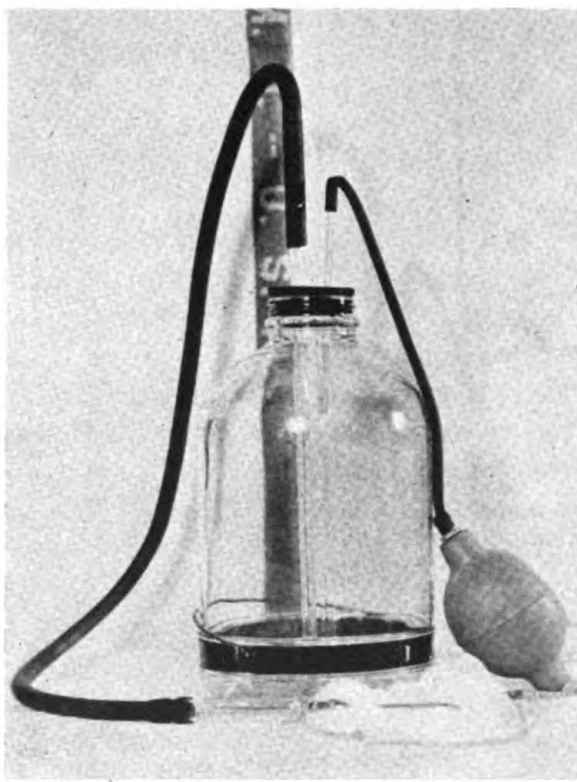
and

RICHARD H. AMES
Lieutenant (MC) U.S.N.R.

A blood transfusion aboard a combat ship is generally regarded as a rather complex and tedious procedure and one which requires the presence of several assistants. Because of this there is a readily understandable tendency for medical officers to compromise by giving plasma or even intravenous fluids in certain cases in which whole blood is indicated.

The apparatus described here can be assembled very easily from materials at hand in any sickbay and eliminates many of the technical difficulties usually encountered in undertaking a transfusion aboard ship.

As shown in the accompanying photograph, an empty Vacoliter flask is used to collect the blood. The small glass tube which originally served as an airway is cut down to a length of 4 to 5 inches and reinserted a short distance into the flask. A length of small rubber tubing joins the end of this tube to a rubber bulb.



The valve in the end of the bulb is reversed so that compression of the bulb creates vacuum instead of pressure in the flask. A second piece of glass tubing, of sufficient size to fit tightly, is inserted through the opposite hole in the stopper, ending about

one inch above the bottom of the flask. An 18- to 24-inch length of rubber tubing connects this tube to a glass adapter. The entire apparatus is wrapped in several thicknesses of muslin, autoclaved, and kept ready for instant use.

Immediately before collecting blood, sodium citrate is drawn into the flask. One ampule, containing 50 cc. of a 2½-percent solution, is usually sufficient for 500 cc. of blood. It is well to clamp the rubber tubing as the last of the citrate solution enters the needle, leaving the tubing filled with this solution. This step materially aids in preventing clots from forming and blocking the flow of blood.

With the operator seated beside the donor table, the donor's arm is prepared in the usual manner and the needle (preferably 16-gage) inserted. As soon as the bevel of the needle is well beneath the skin, the clamp is removed and the rubber bulb squeezed several times. This creates a negative pressure in the system and insures an immediate rapid flow of blood as soon as the vein is entered.

While collecting the blood, the operator steadies the needle with one hand while with the other he alternately compresses the suction bulb and gently agitates the flask to prevent formation of a clot. The flask may conveniently be held between the knees during the former operation.

When the desired amount of blood has been obtained, the needle is withdrawn and the blood in the tubing allowed to drain into the flask.

The stopper is removed from the flask, the neck flamed, and the blood poured through a sterile funnel filled with loosely packed fine-mesh gauze into an ordinary intravenous set.

The apparatus described has been used by us for some 7 or 8 transfusions and has proved itself to be of considerable value, particularly when no assistants were available. No transfusion reactions of any type have been encountered. In 3 instances it was desired to give small (250 cc.) repeated transfusions. The mouth of the flask was covered with sterile gauze and the unused portion of the citrated blood kept in the refrigerator for a 24-hour period. No ill effects were noted following administration of blood stored in this manner.

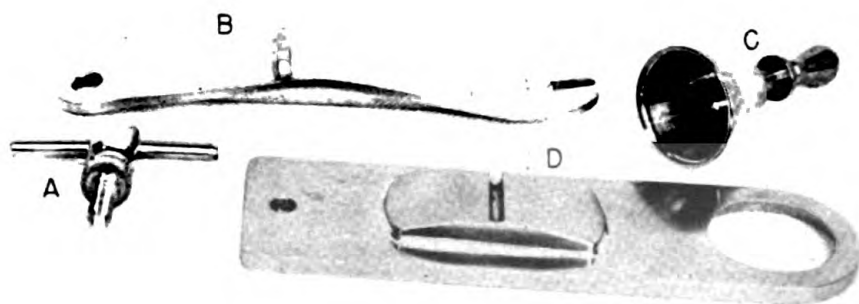
SUGGESTED CHANGES IN INSTRUMENT FOR ADULT CIRCUMCISION

JOHN D. HUBBARD
Lieutenant Commander (MC) U.S.N.R.
and
FORREST M. BRUNSON
Lieutenant, junior grade U.S.N.

Great interest was shown among the medical personnel aboard this vessel in the circumcision instrument described in a recent issue of the BULLETIN¹. A scale drawing was made and, as this vessel is a repair ship, construction of the instrument described by Dr. Field was facilitated.

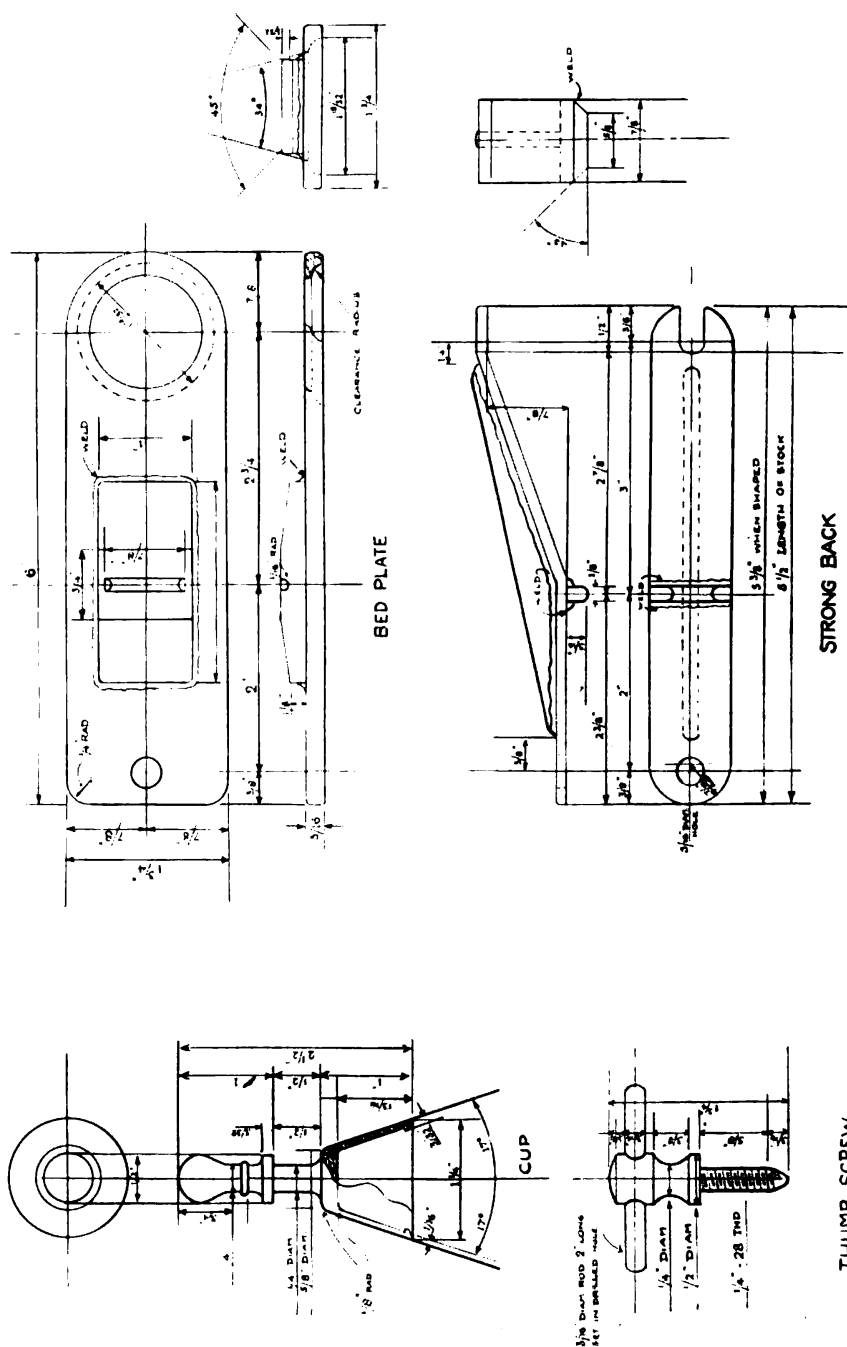
The purpose of this paper is to describe a few changes in the original instrument which we feel will improve its general usefulness. The corrections suggested consist of: (1) Increasing the thickness of the cup; (2) beveling the ring of the bed plate so that a biting surface of 1/16 inch is obtained between the cup and the bed plate; (3) the pegs in the strong back and the holes in the bed plate are replaced by a groove and knife edge; (4) building up the bed plate to establish the fulcrum, made necessary by cutting down on the biting edge of the cup; and (5) the strong back is made in one piece.

The thickness of the cup is increased to insure sufficient strength and to prevent the edge from scratching or cutting into



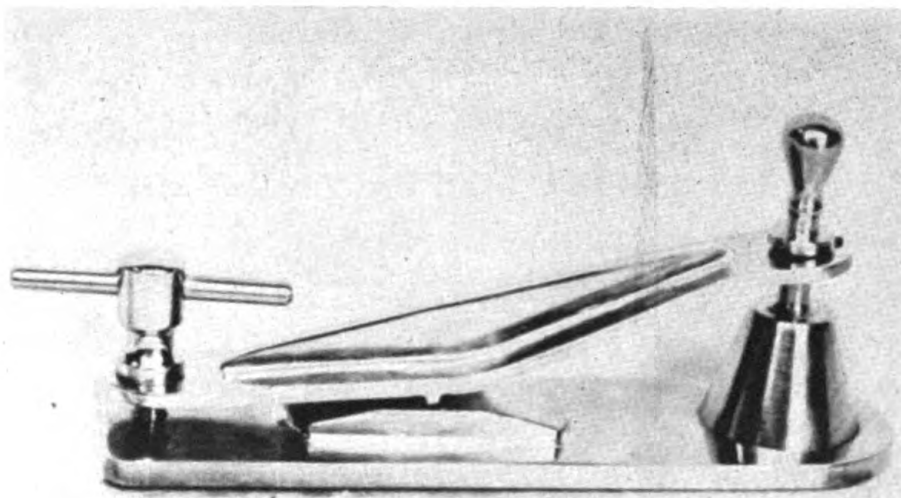
(A) Thumb screw. (B) Strong back. (C) Cup. (D) Bed plate.

¹ FIELD, C. H.: Instrument for adult circumcision. U. S. Nav. M. Bull. 42: 950-955, April 1944.



the glans. It was felt that if the cup should not be firmly seated in the ring when pressure was applied, there was a likelihood that it might crack or collapse.

As the instrument was originally constructed, a cuff of prepuce one-half the thickness of the bed plate results. This necessitates ligating and suturing of the incised edges. To prevent this the bed plate about the ring is beveled on its under surface. The bevel



Assembled instrument.

is such that a biting edge of $1/16$ inch is obtained. Maintaining this concentrated pressure for a period of 5 minutes avoids any necessity of ligating the bleeders. Suturing is also necessary in only a few cases. A ligature placed in each of the quadrants insures approximation of the skin and mucous membrane even though an erection occurs during healing. This change is the one we feel is the most important.

The pegs as described in the original device had a tendency to bind. We did not break any pegs but it was felt that they might break after moderate usage; therefore a knife edge replaces the pegs.

The bed plate was built up $3/16$ inch in order to obtain the necessary fulcrum and pressure desired. It was also a means of providing the groove for the knife edge on the strong back.

The strong back was made in one piece in order to give greater strength and to facilitate its construction. A further refinement was the countersinking about the hole for the pressure screw in the bed plate. The tension screw was more readily seated by this means. The accompanying diagram, drawn to scale, shows these changes.

Use of the instrument has greatly speeded up the time involved in doing circumcisions. The neat, clean edge obtained was found to heal more rapidly and no infection has occurred. Our experience has shown that it is necessary to use considerable tension on the prepuce as the ring is seated on the cup. If this is not done the incision is found to be far short of the desired level.

CANVAS BAG FOR LIFE RAFT FIRST-AID KIT

BURDICK G. CLARKE
Lieutenant (MC) U.S.N.R.

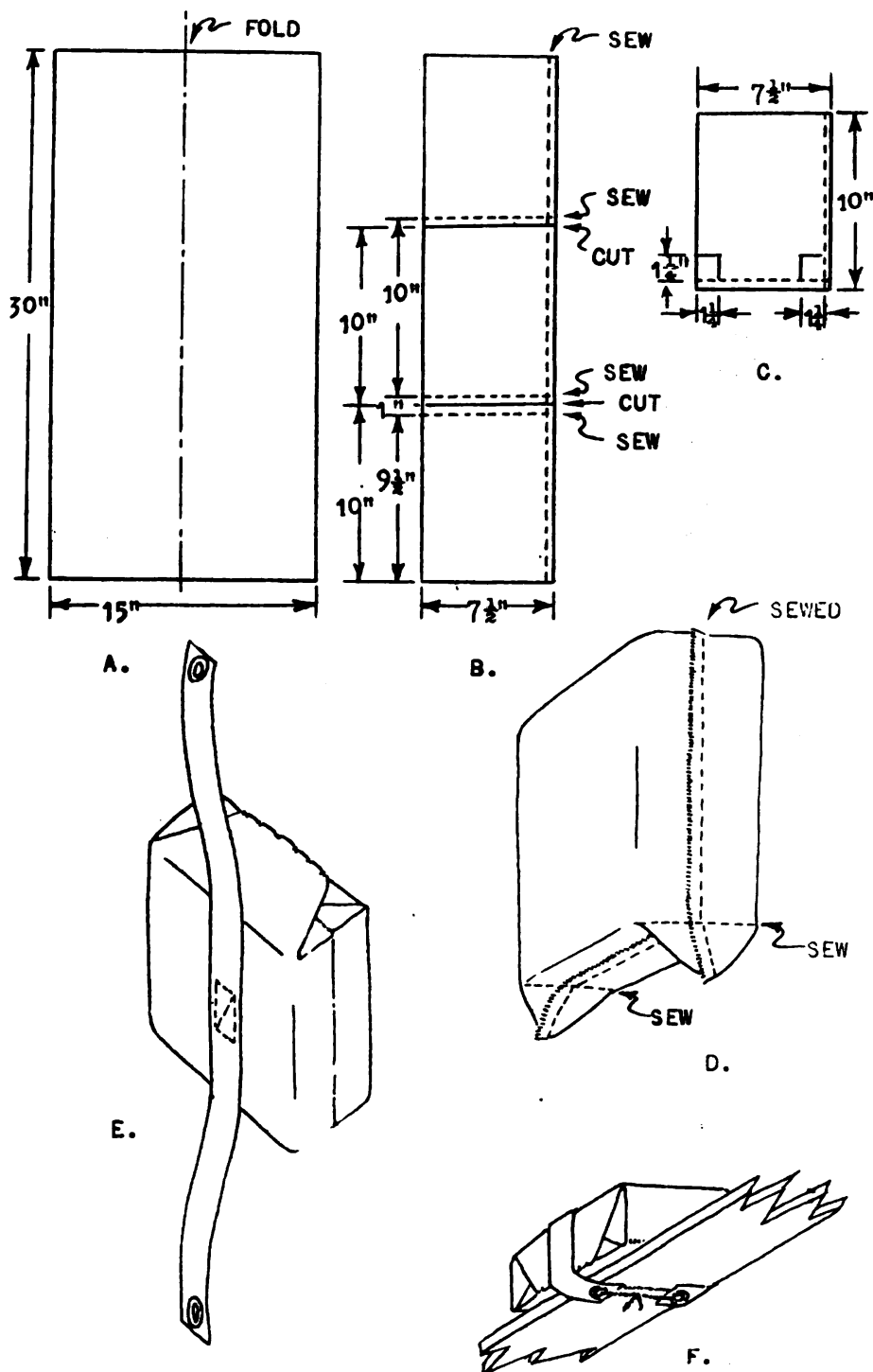
Experience on an amphibious transport has emphasized the desirability of the Navy first-aid kit for life rafts (listed in the Medical Supply Catalog as S2-1056, kit, first-aid—for life rafts of vessels). This compact unit consists of bandage compresses, boric acid ointment, sulfadiazine tablets, powdered sulfanilamide, morphine Syrettes and an iodine applicator, in a waterproof rectangular canister measuring $2\frac{1}{2}$ by $4\frac{1}{2}$ by $4\frac{1}{2}$ inches with tarred leadfoil sides and sealed sheetmetal end-pieces. This is not rugged enough nor are fasteners provided for securing it directly to life rafts. A standard canvas bag was therefore designed (in cooperation with L. E. Kingery, Boatswain U.S.N., L. R. Holland, Chief Boatswain's Mate U.S.N., and D. W. Corlew, Coxswain U.S.N.R.), which has been used satisfactorily on this vessel. Seventy-two of these were made in 30 hours by an experienced sailmaker using a sewing machine; hand sewing would require about half again as much time. Directions for making this bag follow.

Directions: 1. From a bolt of 30-inch canvas, cut a piece 15 inches long and fold as in (A). Sew the cut ends together, forming a double thickness of canvas $7\frac{1}{2}$ inches wide and 30 inches long, open at the selvages. This one piece is used to make three bags (B).

2. Mark crosswise $9\frac{1}{2}$, $10\frac{1}{2}$ and $20\frac{1}{2}$ inches from the bottom selvege and sew the two thicknesses together along these marks. Then cut crosswise 10 inches (between the two close seams), 20 inches from the bottom selvege, making 3 separate sacks (B).

3. At the lower corners of each of these flat canvas sacks mark off a square $1\frac{1}{4}$ inches from the bottom and side seams (C). Pinch the canvas together along these marks, then sew to form the closed end of a rectangular canvas box $2\frac{1}{2}$ by $4\frac{1}{2}$ by 8 inches (D). Clip off the excess from the corners and turn the bag inside out to make the outside seams smooth.

4. Cut pieces of canvas 4 by 30 inches from the bolt, fold and stitch to make double-thickness canvas straps $1\frac{1}{2}$ inches wide, cut into 15-inch lengths, insert No. 0 (diameter of hole $\frac{1}{4}$ inch) rolled-rim spur grommets in both ends, and stitch to the outside of the canvas bags (E). Place the first-aid kit inside the can-



Pattern of canvas bag for first-aid kits for life rafts.

vas "box," fold the open ends over and sew shut by hand (E).

5. Moisten canvas, paint with well-thinned paint to match rafts, stencil if desired with red cross or other device, and the bags are ready to be lashed to the boards of any standard life raft (F). Cotton rope $\frac{1}{8}$ inch in diameter is satisfactory for this purpose.

EDITORIALS

ACRYLIC OCULAR PROSTHESIS

Few things of permanent good come out of wars. To many, medicine apparently is a forlorn loser. Although empirical investigation and research are handicapped it must be conceded that certain practical phases of medicine progress in a manner possible only during a state of war.

Brain surgery, debridement, and immobilization therapy were brought to the fore in World War I. Paramount among the medical advances of the present conflict are plastic, maxillofacial, and rehabilitative surgery.

The Navy's pioneering in acrylic eye prosthesis as described by Murphey and Schlossberg, p. 1085, is unique and the end-results are remarkable. The genuinely natural appearance of the acrylic appliance, its lightness, durability, ease of manipulation are properties unequaled by other prosthetic materials. Radiation factors insure comfort in extremes of temperature and protect against explosion during use. Its uncanny human likeness impresses one even on superficial inspection and casual handling.

The psychologic uplift to the wearer of such a prosthesis is phenomenal and repays every endeavor to bring this appliance within the reach of all affected with the loss of an eye.

SKIN DISEASES IN THE TROPICS

Not the least among the duties of the Naval medical officer is the diagnosis and treatment of skin diseases. To one not thoroughly versed in dermatology this may prove a considerable task. The differentiation of skin lesions and the innumerable possibilities of allergic manifestations only complicate the difficulty. It is not always possible to call for consultation or to refer the patient to a specialist, particularly under warfare conditions. The compromising effects of the tropics, the extreme heat, overcrowded quarters and poor personal hygiene as described by McCann elsewhere in this BULLETIN, p. 1205, only add to the quandary and, as

a consequence, simple skin lesions assume magnitude out of proportion to their seriousness.

It has been said that from 20 to 25 percent of all diseases in the armed forces are the object of dermatosyphilitic management¹. Again in a recent statistical analysis of diseases² in the Navy from 1940 to 1943 inclusive, approximately 10 percent of new admissions for all diseases were attributed to skin diseases; of these 28 percent were for allergic skin conditions. On the other hand the importance of skin diseases is forcibly emphasized in a recent Army publication³ which states that as high as 75 percent of patients reporting to sick call in many dispensaries in the Southwest Pacific area were for skin diseases.

The variations in skin lesions due to tropical environs demand as a counterpart versatility in their therapeutic management. Phillips and Buhler in this BULLETIN, p. 1193, call attention to the fact that commonplace remedies in the temperate zones may only aggravate lesions occurring in tropical and subtropical climates. The use of iodine, salicylic acid compounds, topical sulfonamides and strong keratolytic and antiseptic agents receives appropriate warnings. The abuse of topical sulfonamides has merited a formal condemnation even in this country from at least one leading dermatologic society.

A careless and uninformed attitude toward skin diseases has led to self-treatment. Self-treatment and overtreatment are but species of the same genus. The old adage "a person who treats himself has a fool for a patient" is most pertinent to one who self-medicates, particularly a skin disease in the tropics; not infrequently there follows a superimposed complication more distressing than the primary affection.

The tendency to consider every vesicular disease a fungous infection precludes such conditions as pompholyx, dermatophytides and contact dermatitis. Phagedenic ulcer occurs frequently enough to require differentiation from ecthymatous forms following abrasions, scratches, insect bites and many minor superficial injuries. It must be remembered that miliaria is not the only vesicopustular eruption despite its frequency in tropical climates.

To apply proprietaries and fungicidal solutions under these circumstances without the benefit of medical counsel invites disaster. It has been said that all skin diseases may be divided into those

¹ PILLSBURY, D. M.; SULZBERGER, M. B.; and LIVINGOOD, C. S.: Manual of Dermatology. W. B. Saunders Co., Philadelphia, 1942.

² Prepared by Vital Statistics Section Division of Preventive Medicine, Bureau of Medicine and Surgery, Navy Department, May 31, 1944.

³ News and Comments: Skin diseases in tropics. Bull. U. S. Army M. Dept. No. 80: 10-11, September 1944.

which are cured by zinc oxide and those which are not. However facetious the saying may be, it emphasizes a principle of therapy particularly significant in the tropics.

The empiric character of therapeutics in general necessitates that the application of remedies in dermatologic complaints be mild, that undertreatment be preferred to overtreatment and that considerable discernment be employed in the use of aqueous as against oily preparations. With the introduction of irradiation therapy Phillips and Buhler show what benefits can be expected from a judicious employment of physical agents.

The advantages of a vigorous campaign against self-medication and the necessity of frankness in promptly reporting superficial skin conditions have recently been discussed in the BULLETIN⁴. Adoption of educational programs of this type will prevent minor disease entities from becoming major catastrophies.

CRYPTORCHIDISM

Congenital malposition of the testicles is more common than the literature reveals. According to Smith¹ the frequency of cryptorchidism as reported by different writers varies from 0.11 to 0.2 percent, whereas Lowsley and Kirwin² think that about 4 percent of boys under 15 years show nondescent or partial descent of the testes.

Some years ago, on examination of 123 boys, prior to admission to a boys' summer camp, 9 cases of undescended testes were discovered; 2 of these were examples of typical bilateral cryptorchidism, 4 showed the gland missing on the right side, and 3 had an absent testicle on the left side.

In no instance was there an ectopia. In 2 boys however the testicle was inguinal, being palpable within the inguinal canal at the level of the internal ring; a third boy exemplified the subinguinal type, the left testicle was at the external inguinal ring and could be expressed down as far as the neck of the scrotum. Inability to palpate the testicles in the other youths led to the opinion that the glands were abdominal in position.

The boys' ages ranged from 7 to 16 years. Their economic status

⁴DERZAVIS, J. L., and POPPEN, J. R.: Campaign against "athlete's foot." U. S. Nav. M. Bull. 43: 600-602, September 1944.

¹SMITH, G. G.: Injuries and Diseases of Testicle. Lewis' Practice of Surgery. W. F. Prior Co., Inc., Hagerstown, Md., 1944. Vol. 9, Chap. 28, p. 14.

²LOWSLEY, O. S., and KIRWIN, T. J.: Clinical Urology. 2d edition. Williams & Wilkins Co., Baltimore, 1944. Vol. 1, p. 376.

was typical of any large American city's lower middle class group. The information when conveyed to the boys' parents invariably provoked surprise, and it was affirmed that this was the first time the condition was called to their attention.

Whether these findings reflect a cross section of this income group is speculative despite the feeling of some that anomalies mirror the economic status of peoples.

With war manpower mobilization, circumstances are opportune for collating incidence factors of diseases never before possible. Considerable cataloging and classifying have been accomplished and reported. From these sources³ it is shown that out of a sample of all men examined at local boards between November 1940 and September 1941, the ratio of cryptorchidism per 1,000 examined was 4.7. The size of the sample of men examined was 121,966 which is equivalent to saying that out of every 100,000 men approximately 500 were found with one form or other of this anomaly.

Breaking down this figure into race components, it was learned that the incidence of the defect was 1.8 percent more common in the white than in the colored examinees.

That these figures however do not express the exact rate incidence of the anomaly is evident from the number of men in the armed services with the defect. The incidence of cryptorchidism in the Navy as seen from the annual reports of the Surgeon General for the calendar year 1941 was 26, whereas in 1942 there were 327 cases reported.

As varied as these incidence figures are, the fact remains that the anomaly is common and that maldevelopment in man is of frequent occurrence. If one anomaly in a person is indicative of the presence of others as is often observed in cadavers, then some insight into the number of developmental departures from the normal in the human family is obtained. Inclusion of congenital defects among the causes of rejection for military service consequently may account for an appreciable number of rejectees.

The cause of cryptorchidism is well known. Defective development of the structural route along which the testicle must descend is responsible for the retention or displacement of the gland. Opinions regarding factors involved in creating the defect differ widely and are as numerous as the authors. Economic reasons however appear the least impressive.

³ Medical Statistics Bulletin No. 2. Causes of Rejection and Incidence of Defects, Local Board Examinations of Selective Service Registrants in Peacetime. Annual Analysis of Reports of Physical Examination From 21 Selective States—Table 7.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

THE ART AND SCIENCE OF NUTRITION, A Textbook on the Theory and Application of Nutrition, by *Estelle E. Hawley, Ph. D.*; and *Grace Carden, B.S., The University of Rochester, School of Medicine and Dentistry, Strong Memorial and Rochester Municipal Hospitals, Rochester, N. Y.* 668 pages; 139 illustrations, including 11 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$3.75.

It is always interesting to compare a first edition with a second one, and, before writing this review, I have carefully noted the changes introduced in the period 1941-1944. As would be expected of one so eminent in the field of nutrition, as is Doctor Estelle Hawley, the first edition was so satisfactorily presented that the new edition follows closely the lines of the first edition, the changes being largely those necessitated by recent research in the field of nutrition. In particular we note that the chapter on Vitamins and Vitamin Deficiencies has been increased by eight pages. Very important in the new edition is the preference in designation of vitamin needs on a milligram basis (milligrams and micrograms or gammas— $1/1000$ of a milligram) instead of the various units formerly used.

It is a disappointment that present-day recognition of the seriousness of niacin (nicotinic acid) deficiency is not emphasized. No indication of the lack of adequate niacin in a diet largely excluding meat is given—thus one who relies on a ration of 1 egg, 1 orange and 1 pint of milk is only getting about 1 milligram from such sources, when requirements are probably around 20 milligrams, which deficiency, in a vegetarian, would require excessive consumption of beans, carrots and whole wheat bread. However, one ounce of peanuts will give about as much of niacin

as an ounce of liver (the best source).

For the past five years Spies and his colleagues have been emphasizing the prominence of serious mental symptoms or even psychoses in pellagra, and Sebrell, in 1943, insisted on the importance of the recognition of a severe form of encephalopathic symptoms in the niacin deficiency often noted in older people. The Research Council, in the last few months, has stressed the need for methods of detecting deficiency states. We now recognize the significance of the presence of some substance giving the porphyrinuria reaction, even in cases of pellagra showing psychoneurotic manifestations alone. The dermatitis of pellagra is apt to be late in appearance—the neurasthenic symptoms early.

As would be expected from one so eminent in pediatric research, the chapters on Nutritional Needs in Normal Pregnancy and the succeeding one on lactation and feeding of infants and children are splendid.

The accessibility, practical presentation, and scientific accuracy of this second edition are outstanding.

ELIMINATION DIETS AND THE PATIENT'S ALLERGIES, A Handbook of Allergy, by Albert H. Rowe, M.D., *Lecture in Medicine, University of California Medical School, San Francisco, California.* 2d edition, thoroughly revised. 256 pages. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$3.50.

This handy pocket-size edition (6" x 9½") has a valuable fund of information pertaining to all allergic diseases in addition to those principally produced by foods. The first half of the book is devoted to the diagnosis, cause, and control of sensitivity and contains surprisingly complete lists of inhalants, foods, drugs, contactants, intrinsic and physical antigens. The remainder of the book is concerned with a discussion of the dietary control of the patient with food allergies. After stressing the need for thorough medical examinations and laboratory tests to rule out the presence of other organic disease, the author gives in detail the proper selection and management of elimination diets, explains fully the length of time they must be used to obtain desired improvements, and the necessity of maintaining nutrition. There is included a short discussion of the influence of wartime rationing and shortages on elimination diets, and recipes to enliven the menus. Among other valuable features are the schedules for administration of pollen extracts, discussion of serum administration and reactions, and use of histamine therapy.

Its value is not limited solely to the beginner, but should be of interest to those well acquainted with allergy. It lacks, however, bibliographic references for further study.

ALLERGY IN PRACTICE, by *Samuel M. Feinberg, M.D., Associate Professor of Medicine and Chief of the Division of Allergy, Northwestern University Medical School*; with the collaboration of *Oren C. Durham, Chief Botanist, Abbott Laboratories*. 798 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1944. Price \$8.

The common sense, great practical experience and teaching ability of the author are evident on almost every page of this work. However, some of the discussions of the theoretical and experimental backgrounds are somewhat too sketchy to be absolutely accurate. The presentation of certain allergic diseases, such as contact dermatitis, drug eruptions, and fungous dermatoses appears to be rather scant for over-all usefulness in the management of the often difficult problems presented by these conditions. On the other hand, the information given on such entities as asthma and hay fever should prove more than ample for even the most exacting situations encountered in practice.

In addition to the usual clinical descriptions, lists of allergens, directions for diagnostic and therapeutic procedures, and other standard material, there are several exceptional features. The chapter on fungi as causes of respiratory allergies is beyond doubt the most complete and scholarly presentation of this subject that has yet been published—even though not all investigators attach equal practical importance to this class of allergens.

The chapter on pollens and pollen allergy by Durham is also of exceptionally high quality and thoroughness.

The material presented is huge, and perhaps the sequence, organization and subdivision could be improved upon. However, such minor drawbacks are insignificant in relation to the fact that the diligent reader will find this book a source of much valuable information, presented in a mature manner and evaluated according to exacting, objective standards.

VASCULAR RESPONSES IN THE EXTREMITIES OF MAN IN HEALTH AND DISEASE, by *David I. Abramson, M.D., F.A.C.P.* 412 pages. The University of Chicago Press, Chicago, Ill., publishers, 1944. Price \$5.

This volume is primarily a review of the literature of the physiologic and patho-physiologic responses of the circulatory system; especially the interpretation and correlation of the changes in the peripheral circulation to thermal, dietary, endocrine, chemical and physical factors in health and disease. The extensive material is excellently organized, and well presented in a volume of limited size.

It is apparent throughout that the author's investigative interest and personal experience have been in the academic plethysmographic studies of volumetric changes in the extremities to which

he frequently refers. One chapter of 26 pages describes in detail the equipment and technical procedure with numerous illustrations and charts; otherwise few details, illustrations or charts are given.

The monograph is well indexed, the chapters adequately captioned, and the bibliography is worth having for reference and further study. The anatomy, physiology, pharmacology, and therapeutics of the vascular system are covered to a limited extent. Occasionally the clinical side is briefly referred to but not sufficiently to be of practical value to the practitioner. As described on the cover sheet, the book is recommended for internists, surgeons, dermatologists, physiologists, physiotherapists and pharmacologists. It is also recommended for general practitioners to read and have available for reference, in order better to understand the scientific basis for therapy of systemic and peripheral vascular diseases.

FRACTURES AND JOINT INJURIES, Volumes I and II, by *R. Watson-Jones, B.Sc., M.Ch.Orth., F.R.C.S., Consultant in Orthopaedic Surgery to the Royal Air Force, Director of Orthopaedic and Accident Service, The London Hospital.* 3d edition. 960 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price \$18 per set.

Any book from the pen of Watson-Jones commands respect. This third edition of an already recognized masterpiece in orthopedics has decided advantages over the two previous editions. The broadening of knowledge occasioned by war is reflected in the review of the many cases of injuries that occur but rarely during peacetime. As stated in his preface, the studies of such conditions as fracture-dislocation of the talus had previously been based on isolated experiences whereas in the first year of the war no less than 75 cases had come to the author's attention.

The thorough revision of the work is in contrast to the many so-called new editions coming off the press during these days of dire paper shortage. The addition of sections on open and infected fractures, war wounds, vascular injuries, immersion foot and shelter foot, crush syndrome, gangrene due to tourniquets, dislocation of fractures, burns and their contractures, among others, are not only timely but authoritative and most instructive.

The new recommendations in the therapy of certain orthopedic problems such as supraspinatus tendon rupture, recurrent dislocation of the shoulder, and fractures of the spine are worth close perusal by every orthopedist.

Few medical men have the rare privilege of seeing the realization of pet projects. The sound reasoning in the final chapter of the previous edition regarding rehabilitation, despite reiteration

throughout the intervening war years, required the present war for crystallization into fact. Within a few months of the present outbreak organization of rehabilitation service in wards, centers, and special hospitals on a nation-wide basis throughout Britain made an ideal a realization, and gave the final chapters of this work an importance of international standing.

The present 2-volume edition consists of 6 parts and 37 chapters, is generously illustrated, many being beautifully done in color. The print and format are appealing. This is undoubtedly one of the outstanding contributions published during this war. No medical man, neither specialist nor practitioner, can afford to be without this work.

HYPERTENSION, A Manual for Patients with High Blood Pressure, by *Irvine H. Page A.B., M.D., Director, Lilly Clinic, Indianapolis City Hospital.* 3d printing. 80 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1944. Price \$1.50.

This little book is written expressly for the layman who suffers from hypertension and as such it is to be highly commended.

Throughout the book the author has sought to relieve unwarranted apprehension, but at the same time the serious aspects of the disease are frankly stated. The various mechanical instruments, special tests and laboratory procedures which the patient may expect to encounter are described and their purposes explained. The pathology and mechanics of the disease are outlined in simple terms but in sufficient detail for the patient to be able to understand the rationale of the necessary future modifications in his way of life. The third and last chapter deals with treatment, outlining for the patient in a simple and convincing manner the principles underlying the regimen which he will be asked to follow. Medicinal and operative procedures are discussed but the emphasis is properly placed on a program of moderation, rest, and a minimum of stress and worry.

Through reading this book the intelligent hypertensive patient should obtain much help in understanding his disease and developing a healthy mental attitude toward the condition with which he must live.

THE PRINCIPLES AND PRACTICE OF MEDICINE, Designed for the Use of Practitioners and Students of Medicine, originally written by *Sir William Osler, Bart., M.D., F.R.C.P., F.R.S., by Henry A. Christian, A.M., M.D., LL.D., (Hon.) Sc.D., Hon. F.R.C.P. (Can.), F.A.C.P., Hersey Professor of the Theory and Practice of Physic, Emeritus, Harvard University.* 15th edition. 1498 pages. D. Appleton-Century Co., Inc., New York, publishers, 1944. Price \$9.50.

The fifteenth edition of the Osler-McCrae-Christian textbook

of medicine is, as would be expected, a worthy successor to previous editions. The plan of presentation is similar; the style is lucid and appealing.

Abreast with the times, intelligent foresight in the selection and arrangement of subject matter has made this issue not only opportune but a valuable war contribution.

Special attention has been given to military medicine, tropical diseases, deficiency states, the pneumonias, including virus pneumonia, and the sulfonamides with a few notes on penicillin. The chapter on psychosomatic medicine the reviewer finds very enlightening and recommends it to the general or specialized practitioner who seeks quick but sound information on the subject.

Perhaps the chief virtue of the book is that it serves as a conservative appraisal of the entire field of medicine by a well informed, wise, brilliant clinician, teacher and investigator, Dr. Christian, who certainly has made the book worthy of Drs. Osler and McCrae, the former authors. For this reason the work is probably better appreciated by the mature clinician. The reviewer feels after having read it through, that the adage "look in Osler first" when searching for medical knowledge remains as true today as ever.

CLINICAL UROLOGY, Volumes I and II, by *Oswald Swinney Lowsley, A.B., M.D., F.A.C.S., Director of the Department of Urology (James Buchanan Brady Foundation) of the New York Hospital; and Thomas Joseph Kirwin, M.A., M.S., M.D., F.A.C.S., Attending Surgeon of the Department of Urology (James Buchanan Brady Foundation) of the New York Hospital.* Drawings by *William P. Didusch*. 2d edition. 1769 pages with a 32 page index in each volume. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price \$10 per set.

The appearance of this second edition of *Clinical Urology* is timely and will be received with the same enthusiasm as the first edition released in 1940.

Any work of this scope defies epitomization as it covers most completely the entire field of urology from the fundamental principles of history taking and physical examination and anatomic review to careful descriptions of disease entities, surgical technic and accepted therapeutics.

The general arrangement of the text is the same as in the first edition but some new facts have been recorded. The authors present, in detail, their own modifications of urologic instruments and technical procedures. This creates an aura of respected individualism.

It is quite impossible to praise too highly the splendid skiagrams so carefully selected and reproduced with such unusual clarity. The many illustrations from drawings made at the op-

erating table by the eminent artist, Mr. William P. Didusch, aid greatly in interpretation of the text, and, as the authors agree, curtail verbiage.

The bibliography at the end of each chapter has some unexpected omissions, but it was not intended to be exhaustive and is quite representative of the subjects discussed. There are no footnotes to confuse and annoy the reader. A most commendable feature in arrangement is the printing of the complete index in each volume.

The cloth bindings measure up to the expected high standards of the Williams and Wilkins Company. The print is in clear, bold type.

These volumes are entitled to a place in every physician's library.

INTRAVENOUS ANESTHESIA, by *R. Charles Adams, M.D., C.M., M.S. (Anes.), Associate in Section of Anesthesiology, Mayo Clinic; Instructor in Anesthesiology, Mayo Foundation for Medical Education and Research, Graduate School University of Minnesota, Rochester, Minnesota.* 663 pages; 75 illustrations. Paul B. Hoeber, Inc., New York, publishers, 1944. Price \$12.

This volume "consists of a review of all the available literature on this subject from its inception until the present time" including the various drugs and methods employed, and represents a tremendous undertaking.

Beginning with a short history of the use of intravenous anesthesia and the technic of injection, the agents are then taken up individually. These include chloral hydrate, the first agent used intravenously, avertin, hedonal, ether, isopral, paraldehyde, magnesium sulfate, morphine, alcohol, and the many derivatives of barbituric acid. Four hundred thirty-eight pages are devoted to the barbiturates, of which 86 pages are given to pentothal sodium, the most widely used of all the intravenous anesthetic agents. The chemistry and pharmacology of each drug are adequately reviewed and the effects on the cardiovascular and respiratory systems are given special attention. The work ends with a chapter each on analeptics and intravenous anesthesia in military surgery.

It is a well written, readable and highly informative compilation of our present knowledge of the action and use of the drugs not only for purposes of surgery but also for use in psychiatric, medical and obstetric practice. The author presents a very unbiased picture of the present status of this type of medication and the book is well illustrated with drawings and photographs.

The bibliography is indeed voluminous. For example, the chapter on evipal requires 43 pages, its bibliography an additional 26 pages.

RORSCHACH'S TEST—I. Basic Processes, by *Samuel J. Beck, Ph.D., Head of Psychology Laboratory, Department of Neuropsychiatry, Michael Reese Hospital, Chicago; with a foreword by Willard L. Valentine, Ph.D., Head of Department of Psychology, Northwestern University.* 223 pages; illustrated. Grune & Stratton, New York, publishers, 1944. Price \$3.50.

Of all of the vast assortment of projective and association tests the Rorschach is perhaps the best known. That it is difficult to score and evaluate is, in part, a reflection of the magnitude of the task it sets for itself.

The search for a test-instrument which will give tangible evidence of the personality, has been the quest of investigators for many years. It is natural that workers in the field of the nebulous and ill-defined, seek almost unconsciously to strengthen their conviction by the reassurance of concrete evidence. The publication of Herman Rorschach's "Psychodiagnostik" in 1921 after a 10-year investigation of the problem was coincident with the growth of a "dynamic psychology". The organism-as-a-whole concept and the interdependence of psyche-soma-environment formed the basis for a picture of the personality which bears a greater resemblance to human form than did those early psychologic daguerreotypes. The Rorschach has contributed a new panoramic quality to this approach.

Dr. Beck's second book on the Rorschach test is not a text for the completely uninformed. It presumes a familiarity with the fundamentals and based on that assumption attempts to correlate and coordinate information by injecting an element of formalism into the rather amorphous body of data which has collected around the now classical, ten ink-blot figures.

For the uninitiated, the test consists of the standardized recording of the impressions of a subject to ten ink-blot pictures shown him in succession. The administration of the test is relatively simple; the difficulties arise when an analysis of the results is attempted. The facility with which the examiner can fit individual responses which are unique and personal, into the established generic pattern, determines the accuracy of the resulting personality profile. A high degree of dexterity has been possible heretofore only through intuition and clinical acumen founded on a vast experience. Dr. Beck's book makes this skill available to the tyro by presenting in great detail the ways in which the different responses may be weighed and scored to picture the personality in chiaroscuro.

With the growing use of the Multiple Choice as well as the Group Rorschach tests for selection and screening in the armed forces there has been a concomitant growth of general interest in

the more orthodox version. Dr. Beck's monograph on the Basic Processes will have much value for psychologists and psychiatrists in this field.

VIRUS DISEASES IN MAN, ANIMAL AND PLANT, A Survey and Reports Covering the Major Research Work Done During the Last Decade, by *Gustav Seiffert*. 332 pages. Philosophical Library, New York, publishers, 1944. Price \$5.

In this compact little volume of 332 pages the author has attempted to survey "the major research work done during the last decade" in the field of virology. Included in the survey are the high points in what the author considers to be the most important papers dealing with the chief virus diseases of man, animals and plants.

Section A includes fifteen chapters devoted to a brief discussion of such general topics as the nature of viruses, elementary corpuscles, inclusion corpuscles, the filtering of viruses and the production of virus in crystalline form, the cultivation of viruses, the pathogenesis of virus diseases, immunization in virus diseases and their epidemiology. In this there is little that is new but the papers selected for review appear to be wisely chosen and carefully abstracted.

Section B, Part I, lists and discusses approximately 60 diseases of man, other mammals, and birds in which the causative agent is either known or suspected to be a virus. The author includes in the list as still suspected of having a virus causation, scarlet fever, whooping cough, and acute articular rheumatism; he omits all reference to acute pneumonitis (primary, atypical pneumonia).

In Section B, Parts II, III, IV and V, are discussed viruses in relation to new growths, pox of cold blooded animals, virus diseases in insects, and virus diseases in plants.

Sections C and D summarize the chief papers concerning the "virus-like organisms" (including the stimuli of pleuropneumonia and agalactia, the rickettsia, the bartonella and grahamella, and the bacteriophages) and the "filtrable bacteria forms." With regard to the latter the author states, "The proof of a cycle of development for bacteria has thus far not been incontestably adduced, therefore we cannot yet today speak of special forms of development (aside from the spores of actinomycetes and related microorganisms)—today we can say with certainty that vira are not intermediate filtrable forms of bacteria, but independent living identities, whether regarded as organisms or lifeless substances."

Section E is devoted to a brief but adequate discussion of methods of virus investigation.

Though the work unavoidably suffers somewhat in translation

it represents a tremendous amount of critical culling of the world's literature in the field of virology, combined with a real skill in expressing complex facts in a direct and simple style. It is unfortunate that with publication in 1944 no references subsequent to 1938 were included. This reviewer found the volume readable, and the sources carefully chosen and accurately abstracted. Naval medical officers will find in this little volume a ready and very satisfactory reference for virus problems up to and including 1938. Particularly noteworthy is the way in which the author succeeds in making plain the present gaps in our knowledge of the viruses, and points the way to additional research.

TROPICAL NURSING, A Handbook for Nurses and Others Going Abroad, by A. L. Gregg, M.A., M.D., M.Ch., B.A.O. (Dublin), D.T.M.&H. (Lond.), L.M. (Rotunda Hospital), Member of Associate Staff of, and Lecturer to Nurses at the Hospital for Tropical Diseases, London. 2d edition. 185 pages. Philosophical Library, New York, publishers, 1944. Price \$3.

This book was written specifically for the prospective nurse about to embark on a career of duty in equatorial regions. It contains brief discussions of a few of the diseases and conditions likely to be encountered in the tropics. It gives advice to the nurse (female) concerning what to take with her, and how to react to altered climatic conditions, so that she can best safeguard her own health.

Although there is nothing new in this book, it may be considered to be of some value. It describes symptoms and suggests means of recognizing diseases and conditions not usually seen in temperate regions. Its best feature is its handy pocket size (5 inches x 6 inches), which provides a convenient, easy to carry reference.

NOTES ON NURSING BY A NURSE, by Sarah Corry, R.N., Graduate of Evanston Hospital School of Nursing affiliated with Northwestern University, Evanston, Illinois; with a foreword by Frederick Christopher, B.S., M.D., F.A.C.S., Associate Professor of Surgery, Northwestern University Medical School, Chicago. 144 pages. D. Appleton-Century Co., Inc., New York, publishers, 1944. Price \$1.50.

Many medical officers find themselves obliged to teach nursing to their hospital corpsmen, yet feel they know little about the subject themselves. This is a book for such a person, or for anyone who is already familiar with the basic principles, but not accustomed to doing nursing "on his own."

It does not attempt to be a comprehensive text. In its 150 pages it serves three purposes: (1) A brief review of fundamental bedside nursing, dietetics, and first aid, with reference charts on such subjects as communicable diseases, metric-apothecaries' conversion, and poisons and antidotes; (2) ingenious suggestions for

solving old nursing problems; (3) detailed instructions for equipment required and the nurse's responsibility in the more complicated procedures, such as home delivery and thoracentesis, and treatments new in the last few years, such as the Kenny packs for poliomyelitis, commercial intravenous sets, including field plasma, and improvised Wangenstein suction. A chapter on chemical warfare agents is included.

One might take issue with the vitamin table, which gives the extreme deficiency diseases, to the exclusion of the commoner symptoms of moderate deficiencies. The treatment of burns does not emphasize the method now advised by the Bureau of Medicine and Surgery. These criticisms are minor, however, in a book which is rich in constructive ideas, and at the same time very good reading.

LABORATORY METHODS OF THE UNITED STATES ARMY, by 25 contributors, edited by James Stevens Simmons, B.S., M.D., Ph.D., D.P.H., Sc.D. (Hon.), Brigadier General, United States Army; Chief of the Preventive Medicine Service, Office of The Surgeon General, United States Army; and Cleon J. Gentzkow, M.D., Ph.D., Colonel, Medical Corps, United States Army; Commanding Officer, Deshon General Hospital, Butler, Pennsylvania. Approved by The Surgeon General of the United States Army. 5th edition. 823 pages; 103 engravings and 8 color plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price \$7.50.

The new fifth edition of this well known handbook on laboratory methods has been revised throughout and many sections have been entirely rewritten. The 25 contributors include many outstanding specialists from the Army and various universities.

This edition has been written so as to meet the current needs of the present global war. Also, the book affords a reliable reference on modern laboratory procedures in clinical pathology, chemistry, mycology, bacteriology, helminthology, entomology, special veterinary methods and toxicology, as well as a special section on statistical methods.

The text material is presented in a concise manner in outline form. The headings are in boldface type and subheadings are numbered and lettered. This form of presentation makes for easier reading and quick comprehension of the essential facts. This edition incorporates 108 tables, 103 figures and 8 full page color plates. The color plates of malaria parasites are well presented. The plates of the blood cells can be improved by a better representation of the coloring of cells as appear in a well stained blood smear.

This book makes available a concise and authoritative guide of the essential laboratory procedures used in clinical diagnostic methods, both in armed services and civilian practice.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

CADMIUM POISONING

REPORT OF OUTBREAK

NATHANIEL H. LUFKIN

Commander (MC) U.S.N.R.

and

FRANCIS T. HODGES

Lieutenant Commander (MC) U.S.N.R.

Approximately 25 minutes after completion of the noon meal, 12 men comprising a range detail on a South Pacific island became violently ill with nausea, vomiting, and abdominal cramps. These symptoms increased to such an extent during the next 2 hours that in some instances the vomitus became bloody, and several individuals were in a state of collapse bordering on shock. Within 1 to 2 hours all were suffering from diarrhea with frequent liquid and occasionally bloody stools. A few of the men developed severe cramping pains in the extremities. Within 3 hours after the onset all symptoms became less severe, and in about 5 hours most of the patients were comfortable, except for extreme exhaustion. None had been febrile. The treatment was gastric lavage with weak bicarbonate solution, water and salt by mouth, bismuth and paregoric mixture orally, and morphine hypodermically. Preparation was made for the parenteral administration of salt and water to the more prostrated individuals, but because no actual shock symptoms developed, this precaution proved unnecessary.

Routine questioning elicited these facts. Officers, petty officers and men had eaten different breakfasts at separate messes. The noon meal had been apportioned directly from the general mess at about 1115. It had been packed in closely covered portable metal vacuum containers and delivered to the detail at about 1145. It consisted of bread and butter, mutton stew, creamed corn, potatoes, beans, carrots, and artificial lemonade made from powdered citric acid, dried lemon juice, flavoring, and sugar. The food had been placed hot in nested aluminum vessels, which were stacked and sealed in the container. The beverage with ice added,

was placed directly in a similar container from which the nested vessels had been removed. When served the food was hot and the drink still contained ice.

Despite the fact that the beverage had been well kept, the drink was suspected as the probable source of poisoning, because it was the only portion of the meal of which every man had partaken. Furthermore it was shown that the container had not been properly cleaned before use. It was also noteworthy that there was no illness among those who received portions of the identically prepared food and drink in the general mess. Since the symptoms were almost identical with those resulting from staphylococcal enterotoxin, the tentative diagnosis was bacterial food poisoning. The food and drink containers were immediately collected unwashed and sent by plane to the base hospital at the other side of the island. Samples of the beverage taken from the container, and specimens of vomitus from two patients were also forwarded.

At the hospital's laboratory, smears and cultures were taken from all foods as found in their original containers. No bacteria were demonstrable in the smears. *Clostridium welchii* was isolated in small numbers from all cooked food samples. From the two samples of vomitus were isolated gamma type streptococci and a few colonies of *Staphylococcus albus*. The lemonade was sterile. These findings indicated that the poison was probably other than bacterial in origin. Studies were then initiated to determine whether cadmium was present in the lining of the lemonade container, and whether the element had been dissolved in the beverage.

Systematic analytic procedures were impossible because of lack of references and apparatus. From the U.S. Dispensatory (1) and a textbook of pharmacologic chemistry (2) it was learned that cadmium has the following properties. It is a white metal extensively used for plating because it apparently forms an alloy with the surface metal, thus greatly reducing the possibility of flaking or peeling off. Cadmium and its oxide are soluble in acids. Its acid salts are precipitated from solution by sulfides which produce the characteristically bright yellow cadmium sulfide, used as a pigment in the paint industry. Hydroxides and carbonates added to solutions of cadmium salts produce white precipitates of cadmium hydroxide and cadmium carbonate. Physiologically, cadmium acts similarly to zinc as an emetic, but eight or nine times more strongly. The fatal dose for rabbits is about 60 mg. per kilogram of body weight.

Using this information as a guide a number of tests were made. After washing and drying the beverage container, its inner sur-

faces were rinsed with diluted hydrochloric acid. This was recovered and a portion of it was saturated with hydrogen sulfide gas¹. A bright yellow precipitate appeared at once. After again thoroughly washing and drying the container a potable solution of citric acid, water and sugar was allowed to stand in it for a number of hours. Samples were removed at 1, 2, and 4 hours, and treated with hydrogen sulfide. In increasing amounts the identical yellow precipitate was formed in each sample. A portion of the suspected lemonade was then treated with hydrogen sulfide, and again the yellow precipitate was obtained. In small quantity the same precipitate was produced by treatment of the filtered vomitus. No precipitate could be obtained from water rinsings of the beverage container or from normal gastric juice. When sodium hydroxide was added to the acid rinsings of the container, the lemonade, and the vomitus, white flocculant precipitates developed. Addition of sodium carbonate and sodium bicarbonate solutions produced white powdery precipitates.

These tests constituted presumptive evidence that the lemonade container was lined with cadmium, and that the element had reacted with the lemonade and the resultant cadmium salt had been ingested by the 12 men. Metallic cadmium obtained from a Navy repair ship was dissolved in nitric and hydrochloric acids. Treatment of these solutions in the same manner as those from the beverage container yielded reactions identical in every respect.

It was also determined that cadmium or its oxide is soluble in dilute lactic acid, dilute acetic acid, and in the juice of canned tomatoes². Even after boiling cadmium filings in strong tea (no lemon juice or acid added) only the most minute trace of cadmium could be detected in the filtrate.

COMMENT

Cangelosi (3) in 1941 called attention to the danger of poisoning in the Navy and Marine Corps from the improper use of cadmium-plated food containers. Yet informal inquiry among medical officers and commissary personnel indicates that relatively few of those concerned with the purity of food appreciate the hazards of cadmium.

The food container responsible for this outbreak of cadmium poisoning is admirably designed for the convenient storage and

¹ For use in the production of H_2S , iron sulfide is easily made by the ignition of a mixture of finely clipped steel wool and precipitated sulfur.

² The acidity of tomato juice is due to the presence of citric and malic acids. These acids, singly or together, are found in the juices of a great variety of fresh and canned fruits and berries (4).

transportation of relatively large amounts of prepared hot or cold foods. It is a part of the regular galley equipment of a number of the Navy and Marine field units on this island. None of the containers examined bears any warning as to its use in connection with food or liquid in direct contact with the cadmium-plated inner chamber. It is unlikely that most foods, or plain water or tea would be able to dissolve sufficient quantities of cadmium to produce serious contamination. However it has been shown that the "weak" acid of many common foods and drinks are capable of reacting with the metal in appreciable amounts. A sound precaution therefore would be to prevent direct contact of all foods and drinks likely to react with cadmium-plated surfaces. Instruction of galley personnel and permanent warning labels on the containers should suffice to inform the user of the necessary precautions.

Since the symptoms of acute cadmium poisoning are almost identical with those of acute poisoning by staphylococcal enterotoxin, it is possible that outbreaks of cadmium poisoning have been ascribed to bacteria, as happened in the present outbreak before laboratory studies had been made. Certainly, so long as cadmium-plated vessels or utensils are used in galleys, the possibility of cadmium poisoning should receive early and serious consideration in the differential diagnosis of all outbreaks of acute gastro-enteritis occurring soon after meals.

CONCLUSIONS

1. All cadmium-plated vessels used in or about galleys should be plainly marked with a warning against their improper use.
2. Early and serious consideration should be given to the possibility of cadmium poisoning in all outbreaks of acute gastro-enteritis occurring shortly after meals.
3. Because sodium bicarbonate solution precipitates cadmium salts it is the solution of choice for gastric lavage in the first-aid treatment of acute cadmium poisoning.

REFERENCES

1. United States Dispensatory. 22d edition. WOOD, H. C., JR., and LAWALL, C. H., editors. J. B. Lippincott Co., Philadelphia, 1940. pp. 1288-1289.
2. ROGERS, C. H.: A Text-Book of Inorganic Pharmaceutical Chemistry for Students of Pharmacy and Pharmacists. 2d edition. Lea & Febiger, Philadelphia, 1936. pp. 412-414.
3. CANGELOSI, J. T.: Acute cadmium metal poisoning; report of 3 outbreaks. U. S. Nav. M. Bull. 39: 408-410, July 1941.
4. BRIDGES, M. A.: Dietetics for the Clinician. 4th edition. Lea & Febiger, Philadelphia, 1941. pp. 773-774.

FOOD INFECTION

SEPTIC SORE THROAT EPIDEMIC

RAYMOND H. GOODALE

Commander (MC) U.S.N.R.

and

JAMES G. LAMBRAKIS

Ensign H-V(S) U.S.N.R.

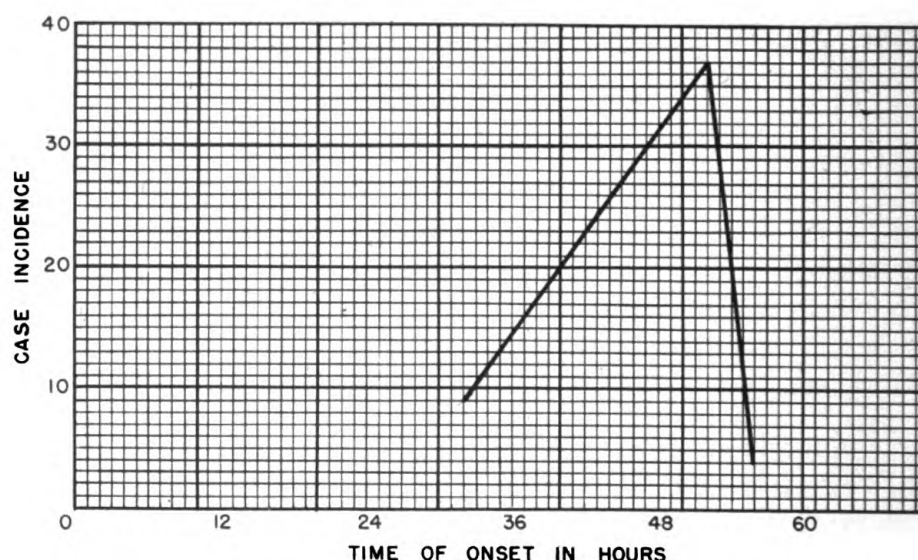
An epidemic of septic sore throat (acute tonsillitis and pharyngitis) occurred at a Naval receiving station on 5 and 6 May 1944. Three hundred eighty-nine patients were hospitalized, all of them enlisted personnel of the Navy and Coast Guard. The epidemic was limited to those who had eaten in one galley. Practically all cases were admitted within a period of 40 hours. The symptoms included prostration, acute sore throat with dysphagia, fever, muscle pains, headache and cervical adenitis. There were no deaths.

The receiving station at which this outbreak occurred has an average population of 7,500 officers and enlisted personnel. The enlisted personnel live in barracks, each of which accommodates about 300 men. Messing facilities are available in 2 galleys and for prisoners in the brig galley. Each general galley serves about 2,800 men per meal, while the brig galley serves 450 to 500 men. All foods are dispensed from a central supply commissary and are prepared by the respective galleys. Breads and pastries are prepared at the station bakery and distributed to the 3 galleys. Milk is supplied from 2 sources; all milk is pasteurized. The ice cream served was supplied by a local commercial concern.

All patients with tonsillitis or pharyngitis from this epidemic were men who had been assigned to galley No. 3 for their meals. No cases were traced to galley No. 2 or to the brig galley.

The distribution of men in the barracks shows that no correlation exists between the living quarters and those sick. Of 50 sick men questioned, analysis shows that they were distributed among 27 different barracks.

Incubation period.—The incubation period for streptococcus sore throat infections is usually between 48 and 96 hours. Two men who reported to the dispensary Friday evening had eaten only the noon meal on Thursday, 4 May. This set a tentative time for the infection of the group. Analysis later showed that egg

Time of onset of infection

0 on graph is time of inoculation (1200, 4 May)

salad eaten at this meal was the agent which spread the infection. Of 79 patients questioned, 83 percent first became ill between 47 and 52 hours after the Thursday noon meal. These figures plotted in the accompanying graph also illustrate the explosive character of this epidemic.

Possible factors operating in an outbreak of septic sore throat include (1) air-borne infection, (2) water-borne infection, (3) milk contamination, and (4) food contamination.

Air-borne infections.—Two factors are contributory to an epidemic of streptococcus sore throat spread through the air: (1) The arrival of a new population on the station, which group may be classified as susceptibles as compared with the population on the station prior to the epidemic; and (2) a carrier rate of between 35 and 50 percent among the population of the station is necessary to the instigation of an air-borne sore throat epidemic. It should be noted, in an epidemic of sore throat disseminated by this means, that the rate incidence manifests a slow relentless tempo as compared with the explosive nature of this epidemic.

An analysis of 51 sick men was carried out to determine the relation between the newly introduced population and the old population. It was assumed that all men who had been on the station up to 9 days prior to the date of the epidemic would be considered susceptibles, and all who had been on the station 10 or more days would be non-susceptibles. Of the 51 men questioned, 43 percent were in the susceptible and 57 percent in the non-susceptible group.

Throat cultures were made from 108 well men to determine the carrier rate of *Streptococcus pyogenes*. Of the 108 men examined, 9.2 percent showed themselves to be carriers of this organism.

As an air-borne epidemic of septic sore throat requires a high carrier rate of between 35 and 50 percent, and as the case incidence was higher among the non-susceptibles, it can be assumed that no correlation exists between this epidemic and air-borne dissemination of the streptococcus.

Water-borne infection.—Water was eliminated as the source of this epidemic. Chlorinated water is distributed generally to all men on the station by scuttlebutts and in iced drinks.

Milk contamination.—Raw milk is most frequently incriminated in epidemics of septic sore throat. All milk used on this station is pasteurized. Analysis concerning those who drank milk and were sick and those who drank milk and were not sick indicates that no correlation exists between this epidemic and the drinking of milk (table 1).

TABLE 1.—*Relation of milk to epidemic*

	Sick	Not sick	Total
Drank milk	35 (36.3 percent)	61 (63.7 percent)	96
Did not drink milk	27 (53.0 percent)	24 (47.0 percent)	51
	62	85	147

Chi-square = 3.1. Interpreted, this means that sore throat could occur by chance 1 in 14 times in this group. The significant figure is 1 in 100.

TABLE 2.—*Menus for Thursday, 4 May 1944*

Breakfast	Lunch	Dinner
Grapefruit (½) Fresh milk, corn flakes Fried ham Hot cakes Mapeline syrup Bread and butter Coffee	Vegetable soup Baked macaroni with cheese Buttered fresh peas Egg salad Tomatoes and onion salad Marble cake, ice cream Bread and butter Iced tea	Rice tomato soup Rib roast of beef Onion gravy Roast brown potatoes Buttered corn Combination salad Blackberry pie Jam, bread Iced tea

Food contamination.—The breakfast, dinner and supper menus for Thursday, 4 May (table 2), were analyzed to determine whether any correlation existed between a particular food and the throat infection. A total of 135 men was questioned. Fifty of these were ill, and 85 were not ill. Of all the foods served statistical analysis pointed to egg salad (served Thursday noon) as the contaminated food. Of those who did not eat the salad 98.4

percent were not sick. In table 3 the significance of this relation is determined by the chi-square value. The chi-square value in this instance is 69, which represents a probability of less than 1 in 1 million times. Therefore sore throat could happen by chance less than 1 in 1 million times among those who ate egg salad.

TABLE 3.—*Relation between those eating and those not eating the egg salad*

	Sick	Not sick	Total
Ate egg salad	61 (71 percent)	25 (29 percent)	86
Did not eat salad	1 (1.6 percent)	60 (98.4 percent)	61
	62	85	147

Chi-square = 69. Probability = less than 1 in 1,000,000

Relation of epidemic to the presence or absence of tonsils.—Seventy-nine men with sore throats and 40 men without sore throats were questioned as to the presence or absence of tonsils. Of the men who had tonsils 71 percent were sick and of the men who did not have tonsils 53 percent were sick. In table 4 the significance of this relation is determined by its chi-square value. The chi-square value in this instance is 2.8 which represents a probability of approximately 1 out of 11, so that the difference between those with tonsils and those without tonsils and the occurrence of sore throat is not more than might be expected to occur by chance. Therefore it is assumed, in this instance, that very little if any correlation exists between this epidemic and the presence of tonsils.

TABLE 4.—*Relation of tonsils to epidemic*

	Sick	Not sick	Total
With tonsils	62 (71 percent)	25 (29 percent)	87
Without tonsils	17 (53 percent)	15 (47 percent)	32
	79	40	119

Preparation of egg salad.—The egg salad was prepared by boiling the eggs the night before. They were shelled Thursday morning and then chopped and mixed with potatoes. The mixing was done by hand. The salad was then placed in three large containers to a depth of 18 to 20 inches. Two containers were placed in the refrigerator, and one was kept in the galley to serve at early noon chow. The two containers in the refrigerator remained there approximately 2 hours. During this time bacteria in the center had a chance to multiply.

Three men on the morning watch who prepared this salad had throat cultures which were positive for *Streptococcus pyogenes*, group A. Of those three, one man actually helped in the preparation of the salad.

Bacteriology.—Cultures were made from the throats of food handlers. Throat cultures were taken on 108 food handlers. Of this number 10 were positive for *Streptococcus pyogenes*. Cultures from the throats of patients showed the presence of *Streptococcus pyogenes*, group A, types 5 and 27. Samples of milk were collected on Monday, 7 May. None of the samples was positive for *Streptococcus pyogenes*.

Cultures were made on dishpans, serving ladles, milk-dispensing containers, copper utensils, spoons, knives and forks. One such copper utensil was positive for the presence of *Streptococcus pyogenes*, group A. None of the food eaten was available for bacteriologic analysis.

RECOMMENDATIONS

1. It was recommended that all carriers of *Streptococcus pyogenes* among the food handlers be given 3 gm. of sulfadiazine daily for 3 days [to clear their throats of streptococci.]

2. Salads and other foods which are mixed by hand and which are not subsequently cooked or baked should be eliminated from the menu.

3. If such foods must be included in the menu, they should be prepared as follows: (a) Mix with a sterile rod and not with the hands. (b) Prepare immediately before eating. (c) When stored in a refrigerator, the food should not be packed over 3 inches deep in the containers.



ABUSE OF REST IN THE SURGICAL PATIENT

Prompt restoration of surgical patients to normal life is an essential feature of convalescent supervision. Early postoperative activity and walking provide manifest modifications in customary convalescent care by which the process of reconditioning may be largely eliminated and early rehabilitation achieved.

The indications for such a program are manifold; no contraindications were apparent in a study of 100 consecutive cases.—**POWERS, J. H.:** Abuse of rest as therapeutic measure in surgery; early postoperative activity and rehabilitation. *J.A.M.A.* 125: 1079-1083, August 19, 1944.

RESPIRATORY DISEASE AND FOOD POISONING¹

Upper respiratory infections in food handlers as a cause of food poisoning outbreaks are often overlooked or minimized. As a result, the detection and isolation of food handlers with respiratory disease have not received the attention that is warranted by the importance of the preventive measures involved.

An outbreak of food poisoning at a Naval station in May 1944 illustrates clearly the problems encountered in preventing contamination of food with pathogenic organisms from respiratory discharges. A total of 194 cases of gastro-enteritis developed from 5 to 6 hours after eating ham which later was demonstrated bacteriologically to be heavily contaminated with staphylococci. A cook convalescing from a respiratory infection and whose throat culture showed a predominance of staphylococci was considered the only likely origin of the contamination. He had recently been discharged from sickbay and shortly after cooking the hams it became necessary to return him to the sickbay for further treatment of his illness.

It is evident that this man had not fully recovered from his respiratory infection at the time he was cooking in the galley. Consequently, he introduced staphylococci directly into the food by coughing or sneezing, or indirectly by previously contaminating his hands or cooking utensils.

Despite the diagnosis of the cook's upper respiratory infection and his subsequent isolation, his premature discharge from sickbay led to the food poisoning outbreak. A practical criterion in determining the termination of the isolation period for a communicable upper respiratory infection at least should be a clinical cure. Only when the clinical signs and symptoms have completely subsided, should a food handler be allowed to resume his normal duty.

The sliced ham implicated in the described outbreak was kept at galley temperature for 4 hours prior to consumption. At this temperature the multiplication of organisms is favored and if the organisms produce a toxin, such as staphylococcal enterotoxin, production is materially and significantly increased.

Elimination of the incubation period by boning and slicing the ham shortly before serving could have prevented the outbreak. Refrigeration at 45° F. or less during the 4-hour interval would have accomplished the same result.

¹ Report submitted by Epidemiology Unit No. 11.

In conclusion, the importance of isolating food handlers with respiratory infections until clinically well cannot be overemphasized. The failure to do so as part of the medical supervision of food handlers may result in the transmission of disease, equally as well as inadequate consideration of the proper care in the preparation, protection, and handling of food until it is consumed.

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000 average strength) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau of Medicine and Surgery for the months of April, May, and June 1939-1944:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1939	387	339	48	7	85	90
1940	482	431	51	48	118	83
1941	461	413	47	47	118	51
1942	459	411	48	44	137	39
1943	526	479	47	46	181	28
1944	392	346	45	28	100	24

FORCES ASHORE

1939	380	332	48	12	104	41
1940	498	446	53	43	144	52
1941	524	476	48	72	152	36
1942	472	427	45	50	151	25
1943	554	508	46	54	199	23
1944	411	369	42	33	112	23

FORCES AFLOAT

1939	391	343	47	4	75	117
1940	470	420	50	52	99	105
1941	404	358	46	25	89	65
1942	429	374	54	32	108	71
1943	423	373	51	18	114	47
1944	332	277	55	13	64	29

NOTES ON OUR RESERVE CONTRIBUTORS

Ames, Richard H., Lieutenant (MC) USNR (*Improvised Donor Set for Giving Indirect Transfusions*, p. 1251). M.D., Duke University School of Medicine, 1940. Intern, Duke Hospital, Durham, N. C., 1941-42.

Baganz, Crawford N., Lieutenant Commander (MC) USNR (*Mental Mechanisms and Morale Factors of Naval Recruits in Training*, p. 1137). B.S., Indiana University, 1928; M.D., Indiana University School of Medicine, 1930. Private practice, Uniondale, Ind., 1931-35; neuropsychiatrist, Veterans' Administration Facility, Lyons, N. J. and Northport, N. Y., 1935-42. Fellow: American College of Physicians; American Medical Association; American Psychiatric Association; member: Association for Research in Nervous and Mental Diseases; American Association for the Advancement of Science; Indiana State Medical Association; New York Society for Clinical Psychiatry; New Jersey Neuropsychiatric Association. Diplomate American Board of Psychiatry and Neurology.

Bakst, Henry J., Lieutenant Commander (MC) USNR (*Daily Use of Benzadrine Sulfate Over a Period of Nine Years*, p. 1228). Ph.B., Brown University, 1927; M.D., Harvard Medical School, 1931. Teaching fellow in embryology, Brown University, 1927; teaching fellow in histology, Harvard Medical School, 1928-31; resident in medicine, 1932-34, and executive assistant, 1934, Boston City Hospital; assistant in medicine, 1933-35, and instructor in medicine, 1935-41, Boston University School of Medicine; visiting physician: Boston City Hospital; Massachusetts Memorial Hospital, Boston. Diplomate American Board of Internal Medicine.

Barnes, LaVerne A., Lieutenant Commander H-V(S) USNR (*Pathogenic Enteric Bacilli*, p. 1178). B.S., 1925, M.S., 1928, Ph. D., 1929, State College of Washington. Demonstrator in bacteriology, Western Reserve School of Medicine, 1925-26; teaching fellow in bacteriology, State College of Washington, 1926-29, senior instructor in bacteriology, Western Reserve School of Medicine, 1929-31; senior bacteriologist, Massachusetts Department of Public Health, 1931-; assistant in preventive medicine, Harvard Medical School and School of Public Health, 1931-. Fellow American Public Health Association; member: Society of American Bacteriologists; American Association of Immunologists; Massachusetts Public Health Association. Co-author, *Biology of Pneumococcus*, Commonwealth Fund, 1938.

Buhler, Victor B., Lieutenant Commander (MC) USNR (*Dermatologic Conditions Prevalent in Tropical Areas*, p. 1193). A.B., Kansas University, 1930; B.S. (in medicine) and M.D., University of Kansas School of Medicine, 1934. Intern, 1934-35, and resident in medicine, 1935-36, Ancker Hospital, St. Paul, Minn.; resident in pathology, 1926-40, and pathologist, May 1940-June 1942, Kansas City (Mo.) General Hospital. Fellow American Medical Association; member: Jackson County Medical Society; Missouri State Medical Association; Kansas City Pathological Society; Kansas City Academy of Medicine; Kansas City Southwest Clinical Society; Southern

Medical Society; American Society of Clinical Pathologists. Diplomate American Board of Pathology.

Carmody, John T. B., Commander (MC) USNR (*Cerebral Symptoms in Malaria*, p. 1157). A.B., Yale College, 1927; M.D., Yale University, 1932. Intern, general surgery, 1932-33, resident in orthopedic surgery, 1934-35, Lakeside Hospital, Cleveland, Ohio; house officer, neurosurgery, 1933-34, resident, neurosurgery, 1935-37, and assistant neurosurgeon, Massachusetts General Hospital, Boston; demonstrator, orthopedic surgery, Western Reserve University School of Medicine, 1934; neurosurgeon: Worcester Memorial Hospital, 1937; Worcester City Hospital, 1939; Worcester State Hospital, 1938. Fellow: American College of Surgeons; American Medical Association; member Massachusetts Medical Association.

Clarke, Burdick G., Lieutenant (MC) USNR (*Canvas Bag for Life Raft First-Aid Kit*, p. 1256). A.B., Harvard University, 1938; M.D., Harvard Medical School, 1942. Intern, Massachusetts General Hospital, Boston, 1942-43.

Cohen, Maynard I., Lieutenant (MC) USNR (*Acute Infective Jaundice and Acute Hepatitis*, p. 1166). A.B., Harvard University, 1936; M.D., Johns Hopkins University School of Medicine, 1940. Intern: Sydenham Hospital, Baltimore, Md., July-Dec. 1940; Babies' Hospital, Medical Center, New York City, Jan. 1941-June 1942.

Cuono, Joseph D., Lieutenant (MC) USNR (*Traumatic Hemothorax*, p. 1107). B.S., New York University, 1932; M.D., New York Medical School, 1936. Intern, St. Joseph's Hospital, Paterson, N. J., 1936-38; private practice, Paterson, N. J., July 1938-Jan. 1940; assistant resident, surgery, Jan. 1940-July 1940, and resident, thoracic surgery, July 1940-July 1942, Sea View Hospital; assistant visiting thoracic surgeon, Metropolitan Hospital, New York City. Member Bergen County Medical Society, N. J.

Fetterman, George H., Lieutenant Commander (MC) USNR (*The Cold Agglutination Test*, p. 1128). B.S., University of Pittsburgh, 1929; M.D., University of Pittsburgh School of Medicine, 1930; M.A., Graduate School, University of Toronto, 1934. Intern, July 1930-July 1931, and resident in pathology and bacteriology, July 1931-July 1932, Mercy Hospital, Pittsburgh, Pa.; Intern in pathology, July 1932-July 1933, and assistant pathologist, July 1932-July 1933, Toronto General Hospital; director of laboratories, Pittsburgh City Home and Hospitals, Mayview, Pa., July 1934-Feb. 1939; pathologist, St. Margaret Memorial Hospital, Pittsburgh, 1939-; consulting pathologist, Pittsburgh City Home and Hospitals, 1939-; demonstrator in pathology, University of Pittsburgh School of Medicine, 1934-. Fellow American Medical Association; member: Medical Society of the State of Pennsylvania; Allegheny County Medical Society; American Society of Clinical Pathologists; American Association of Pathologists and Bacteriologists. Diplomate American Board of Pathology.

Gardner, W. James, Lieutenant Commander (MC) USNR (*Tantalum in the Immediate Repair of Traumatic Skull Defects*, p. 1100). Washington and Jefferson College, 1920; M.D., University of Pennsylvania School of Medicine, 1924. Intern, 1924-26, and assistant in neurological surgery, 1926-29, Hospital of the University of Pennsylvania, Philadelphia; consultant in neurological surgery: Glenville Hospital, Lutheran Hospital, and Mount

Sinai Hospital, Cleveland; neurological surgeon, Cleveland Clinic Foundation Hospital. Fellow: American College of Surgeons; American Medical Association; member: Central Neuropsychiatric Association; Society of Neurological Surgeons. Diplomate American Board of Neurological Surgery.

Goodale, Raymond H., Commander (MC) USNR (*Food Infection*, p. 1277). B.S., Wesleyan University, 1920; M.D., Harvard Medical School, 1924. Adjunct professor in pathology, American University, Beirut, Syria, 1926-29; associate pathologist, 1929-31, and pathologist, 1931-, Worcester City Hospital, Worcester, Mass.; assistant professor in experimental pathology, Boston University School of Medicine, 1935-. Member: American Medical Association; American Association of Pathologists and Bacteriologists; New York Pathological Society. Diplomate American Board of Pathology. Author, *Interpretation of Laboratory Findings*, 1936.

Gurley, Lycurgus, M., Jr., Lieutenant (MC) USNR (*Pterygium Transplantation by Simplified Method*, p. 1114). B.S., University of Pittsburgh, 1931; M.D., Temple University School of Medicine, 1933. Intern and surgical resident, Conemaugh Valley Memorial Hospital, Johnstown, Pa., 1933-35; general practice, 1935; resident surgeon, Wills Hospital, Philadelphia, Pa., 1936-37; associate ophthalmologist, 1938-39, and chief ophthalmologist, 1939-, Conemaugh Valley Memorial Hospital. Fellow American Medical Association; member: Cambria County (Pa.) Medical Society; Wills Hospital Society.

Hodges, Francis T., Lieutenant Commander (MC) USNR (*Cadmium Poisoning*, p. 1273). A.B., Indiana University, 1930; M.D., Indiana University School of Medicine, 1933. Intern, U. S. Public Health Service, 1933-34; ship's surgeon: Matson Line, 1934; Grace Line, 1934; Dollar Line, 1935-36. Fellow American Medical Association; member Marion County Medical Association.

Hubbard, John D., Lieutenant Commander (MC) USNR (*Suggested Changes in Instrument for Adult Circumcision*, p. 1253). M.D., Hahnemann Medical College and Hospital of Philadelphia, 1933. Intern, J. Lewis Crozer Homeopathic Hospital, Chester, Pa., 1933-34; rotating intern, 1933-34, and surgical service, 1935-41, Homeopathic Hospital, Providence, R. I. Fellow: American College of Surgeons; American Medical Association; member: Providence County Medical Society; Rhode Island Medical Society.

Humphrey, Arthur A., Commander (MC) USNR (*Cold Hemagglutination Test in Diagnosis of Primary Atypical Pneumonia*, p. 1117). B.S., University of South Dakota; M.D., Northwestern University Medical School, 1928. Resident, Iowa Methodist Hospital, Des Moines, Iowa, 1928-29; fellow in pathology, Mayo Clinic, until 1932. Consultant in pathology to the Leila Y. Post Montgomery Hospital, Community Hospital, and the Battle Creek Sanitarium, Battle Creek, Mich.; consulting pathologist to the Michigan Community Health Project through the W. K. Kellogg Foundation. Member: American Medical Association; American Society of Clinical Pathologists; Michigan Pathology Society; State and County medical societies. Diplomate American Board of Pathology.

Lambrakis, James G., Ensign H-V(S) USNR (*Food Infection*, p. 1277). B.S., Ohio State University, 1939. Epidemiologist and sanitary engineer.

Legge, Robert F., Commander (MC) USNR (*Avulsion of Forearm*, p. 1236). A.B., University of California; M.D., C.M., McGill University Faculty of Medicine, 1930. Clinical clerk, St. Bartholomew's Hospital, London, 1930; intern: Peter Bent Brigham Hospital, Boston, Mass., 1931; Southern Pacific General Hospital, San Francisco, 1931-32; assistant resident surgeon, 1932-33, and resident in orthopedics, 1933-35, Henry Ford Hospital, Detroit, Mich.; orthopedic house officer: Massachusetts General Hospital and Children's Hospital, Boston, 1935-36; private practice, Oakland, Calif., 1936-41; assistant orthopedist, Ernest V. Cowell Memorial Hospital, Berkeley, Calif.; staff: Alta Bates Hospital, and Berkeley Hospital, Berkeley; Highland-Alameda County Hospital, Children's Hospital of the East Bay, Peralta Hospital, and Providence Hospital, Oakland; clinical assistant orthopedic surgeon, University of California Medical School, San Francisco. Fellow American College of Surgeons; member: American Medical Association; American Academy of Orthopaedic Surgeons; Western Orthopaedic Association. Diplomate American Board of Orthopaedic Surgery.

Lufkin, Nathaniel H., Commander (MC) USNR (*Cadmium Poisoning*, p. 1273). B.S., University of Minnesota, 1923; M.B., 1925, M.A. and M.D., 1927, University of Minnesota Medical School. Teaching fellow, department of pathology, University of Minnesota Medical School, 1926-28; pathologist: Minneapolis General Hospital, 1928-38; St. Barnabas Hospital, Minneapolis, Minn., 1938-41; associate professor of pathology, University of Minnesota Medical School. Fellow American Medical Association; member: Minnesota State Medical Association; Minnesota Pathological Society; American Society of Clinical Pathologists. Diplomate American Board of Pathology.

Luykx, H. M. C., Lieutenant H-V(S) USNR (*Biostatistics in Medical Research*, p. 1208). B.S., 1930, and M. S., 1931, Massachusetts Institute of Technology. Manager, Service Bureau, International Business Machines Corporation, Detroit, Mich., 1932-35; chief, tabulating division, U. S. Public Health Service, Detroit, Mich., 1935-38; instructor in preventive medicine, New York University College of Medicine, 1938-; instructor, Graduate Division for Training in Public Service, New York University, 1940. Member: American Public Health Association; Public Health Association of New York City; Institute of Mathematical Statistics (1941-43); American Association for the Advancement of Science.

McCann, Walter J., Lieutenant Commander (MC) USNR (*Treatment of Skin Diseases on an Attack Transport*, p. 1205). B.S., Manhattan College, 1926; M.D., Columbia University College of Physicians and Surgeons, 1930. Intern, general surgery, St. Francis Hospital, Bronx, New York City; resident, skeletal surgery, Morrisania City Hospital, New York City, 1932-33; resident surgeon, 1933-35, and attending surgeon, 1936-, St. Elizabeth's Hospital, New York City; assistant attending surgeon, Morrisania City Hospital, 1937-. Member: American Medical Association; New York County Medical Association.

McCorkle, James K., Lieutenant (MC) USNR (*Hippuric Acid Liver Function Test in Relation to Malaria and Atabrin*, p. 1163). A.B., University of California, 1934; M.D., C.M., McGill University Faculty of Medicine, 1940. Intern, Barnes Hospital, St. Louis, Mo., 1940-41; assistant resident in medicine, Royal Victoria Hospital, Montreal, Que., 1941-42.

McGinn, Sylvester, Lieutenant Commander (MC) USNR (*Cerebral Symptoms in Malaria*, p. 1157). A.B., Dartmouth, 1926; M.D., Harvard Medical School, 1929. Intern, Rhode Island Hospital, Providence, R. I., 1930-31; resident in cardiology, Massachusetts General Hospital, Boston, Mass., 1931-33; instructor, Post Graduate School of Medicine, Harvard University; assistant in medicine, Massachusetts General Hospital; assistant physician, St. Elizabeth's Hospital, Boston; cardiac consultant: Robert Breck Brigham Hospital, Boston; Sturdy Memorial Hospital, Attleboro, Mass.; Cape Cod Hospital, Hyannis, Mass.; McLean Hospital, Belmont, Mass. Fellow American Medical Association; member: Massachusetts Medical Society; American Heart Association.

McGuire, William P., Lieutenant Commander (MC) USNR (*Construction of a Contact Lens*, p. 1239). M.D., University of Virginia Department of Medicine, 1935. Intern, Union Memorial Hospital, Baltimore, Md., 1935-36; resident: Institute of Ophthalmology, Presbyterian Hospital, New York City, 1937-40; ophthalmologist, Winchester Memorial Hospital, Winchester, Va. Fellow American Medical Association; member: Medical Society of Virginia; Southern Medical Association; American Academy of Ophthalmology and Otolaryngology; Association for Research in Ophthalmology; American Laryngological Association. Diplomate American Board of Ophthalmology.

Mearin, Robert J., Lieutenant (MC) USNR (*Mental Mechanisms and Morale Factors of Naval Recruits in Training*, p. 1137). B.S., Niagara University, 1928; M.D., Syracuse University College of Medicine, 1934. Intern, St. Joseph Hospital, Syracuse, N. Y., 1934-35; resident psychiatric physician, Creedmore Hospital, New York City, 1935-37; associate physician: Out-patient department, Syracuse Psychopathic Hospital, 1938; Twin Elms, Syracuse, 1938; neurological clinic, Syracuse Free Dispensary; instructor, Syracuse University College of Medicine, 1938; associate attending physician, General Hospital, Syracuse, 1938; private practice, Syracuse, N. Y., 1938-42. Fellow: American College of Physicians; American Medical Association; member: New York State Medical Society; Onondaga County Medical Society; Syracuse Academy of Medicine; American Psychiatric Association; Association for Research in Nervous and Mental Diseases; American Association for the Advancement of Science.

Moran, Thomas J., Lieutenant (MC) USNR (*The Cold Agglutination Test*, p. 1128). B.S., University of Pittsburgh, 1936; M.D., University of Pittsburgh School of Medicine, 1936. Assistant pathologist, Dec. 1937-Mar. 1939, and director of laboratories, Mar. 1939-, Pittsburgh City Home and Hospitals, Mayview, Pa. Fellow: American Medical Association; American Society of Clinical Pathologists; member Pittsburgh Clinical Pathological Society.

Murphey, Phelps J., Lieutenant Commander (DC) USNR (*Eye Replacement*, p. 1085). D.D.S., Baylor University College of Dentistry, 1926. Postgraduate instruction: International School of Orthodontics, 1926; Dental Institute, University of Vienna, 1937. Consultant: Freeman Memorial Clinic; Texas Children's Hospital; Bradford Memorial Hospital for Children, Dallas, Tex.; private practice, Dallas, 1925-42; associate professor, department of bacteriology and immunology, College of Dentistry, Georgetown University. Member: Dallas County Dental Society; Texas State Dental Society; Amer-

ican Dental Association; Dallas Academy of Dental Research; American Society of Dentistry for Children; associate Chicago Dental Society.

Phillips, Kenneth, Lieutenant Commander (MC) USNR (*Dermatologic Conditions Prevalent in Tropical Areas*, p. 1193). M.D., Rush Medical College, 1926. Intern, Wesley Memorial Hospital, Chicago, Ill., 1926-27; medical resident, James M. Jackson Memorial Hospital, Miami, Fla., 1 year; chief, medical service, James M. Jackson Memorial Hospital; medical director, Miami Physical Therapeutic Centre. Fellow: American College of Physicians; American Medical Association; member: American Congress of Physical Therapy; American Therapeutic Society; Southern Medical Association.

Roberts, Gilbert J., Lieutenant Commander (MC) USNR (*Congenital Choanal Atresia*, p. 1216). A.B., University of Illinois, 1925; M.D., Stanford University School of Medicine, 1930. Resident in otorhinolaryngology, 1930-32, Stanford University Hospitals; private practice, Pomona, Calif., 1932-42; attending staff, Los Angeles County Hospital, 1936-42; instructor in otorhinolaryngology, University of Southern California School of Medicine, 1936-42. Fellow American Medical Association; member: California Medical Association; Los Angeles County Medical Society; Los Angeles County Society of Ophthalmology and Otolaryngology; American Academy of Ophthalmology and Otolaryngology; American Laryngological, Rhinological and Otological Society.

Schlossberg, Leon, Lieutenant H-V(S) USNR (*Eye Replacement*, p. 1085). Graduate medical illustrator, School of Art as Applied to Medicine, Johns Hopkins University Medical School, 1933. Free lance medical illustrator, Johns Hopkins Hospital, 1933-42.

Thirlby, Richard L., Lieutenant (MC) USNR (*Hemoglobinuria Following Plasmochin Therapy*, p. 1232). A.B., Dartmouth College; M.D., Harvard Medical School, 1941. Intern, University Hospital, Ann Arbor, Mich., July 1941-July 1942.

Thompson, Charles M., Lieutenant Commander (MC) USNR (*Periarthritis Nodosa*, p. 1220). M.D., Hahnemann Medical College and Hospital of Philadelphia, 1931. Intern, 1931-32, and assistant visiting physician, gastroenterological service, 1934-41, Abington Memorial Hospital, Abington, Pa.; private practice, Newtown, Pa., 1932-41. Fellow American Medical Association; associate American College of Physicians; member: Medical Society of the State of Pennsylvania; Bucks County Medical Society; National Gastroenterological Association.

Wald, Samuel S., Commander (DC) USNR (*Chemotherapy and X-ray Radiation in Treatment of Cellulitis of the Head and Neck*, p. 1200). D.D.S., New York University College of Dentistry, 1928. Instructor of roentgenology, 1928-33, and assistant professor of roentgenology, 1933-, New York University College of Dentistry; lecturer in dental radiology, New York University College of Medicine, 1930-; head, department of roentgenology and oral diagnosis, Guggenheim Dental Clinic and School for Dental Hygienists, New York City, 1930-; visiting dental surgeon, Nazareth Trade School, Farmingdale, L. I., 1928-41; consultant, dental service, U. S. Naval Hospital, Brooklyn, N. Y., 1929-33; consultant in charge of roentgenology and oral diagnosis, Dental Clinics of the Community Service Society, New York City, 1935-; director, dental service, Civilian Conservation Corps,

District No. 1, New Jersey, 1934-35. Fellow: American College of Dentists; New York Academy of Dentistry; member: American Dental Association; Pan American Medical Association, Section of Dentistry and Oral Surgery (secretary, 1940); Dental Society of the State of New York; First District Dental Society. Coauthor, *Clinical Dental Roentgenology, Technique and Interpretation*, W. B. Saunders Co., Philadelphia, 1940.

Weeks, Dana A., Lieutenant (MC) USNR (*Observations on Malaria*, p. 1171). A.B., University of Rochester, 1931; M.D., C.M., McGill University Faculty of Medicine, 1936. Demonstrator in histology, McGill University, 1932-33; intern: Physicians Hospital, Plattsburg, N. Y., 1935-36; Royal Victoria Hospital, Montreal, Que. (3 months), 1936; private practice, Peru, N. Y., Oct. 1936-; attending physician, Physicians Hospital, Plattsburg, N. Y.; assistant attending physician, Champlain Valley Hospital, Plattsburg. Fellow American Medical Association; member: Medical Society of the State of New York; Clinton County Medical Society.

Woods, Walter A., Ensign D-V(S) USNR (*Mental Mechanisms and Morale Factors of Naval Recruits in Training*, p. 1137). A.B., University of Wyoming, 1937; M.A., Syracuse University, 1942. Resident adviser, Syracuse University, 1938-39; field assistant, Federal Security Agency, 1939-42.

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 43

INDEX TO SUBJECTS

	PAGE
APD, medical experiences on an.....	930
Abdominal pain, recurrent, amebiasis as cause of.....	527
Abscess, parafrenal, complication of gonorrheal urethritis.....	543
Achalasia in military service; treatment and disposition.....	1111
Acrylic dentures, processing; compression and injection method.....	297
Acrylic maxillofacial prosthesis in eye replacement.....	1085
Acrylic ocular prosthesis	1258
Acrylic restorations, fixed anterior.....	301
Action, amphibious, hospital ship in.....	937
Adherent scars of the lower extremity.....	878
Advance Naval base hospital, cystoscopic clinic at.....	763
Aerial evacuation of thoracic wounded; consideration of effects of altitude in	685
Aero-embolism in a diver.....	538
Aftercare of amputations of lower extremity, physical therapy in.....	634
Agar, chocolate, with bacto-supplement-A as culture medium, advantages of; cultivation of the gonococcus.....	409
Agglutination test, cold, evaluation of, in primary atypical pneumonia.	433
Agglutination test, cold; I. Studies on Naval hospital patients; II. Studies on natives in yaws-endemic area.....	1128
Agranulocytosis treated with penicillin.....	1014
Air embolism in immersion blast.....	871
Airsickness	34
Albuminuria in applicants for Naval enlistment, study of.....	321
Altitude, consideration of effect in aerial evacuation of thoracic wounded	685
Ambulation, early, of the surgical patient.....	380
Ambulatory program following operation for unruptured appendicitis.	232
Amebiasis as cause of recurrent abdominal pain.....	527
Amphibious action, hospital ship in.....	937
Amphibious operations, mobile surgery unit for.....	552
Amphibious warfare, medical problems in; the LST in evacuation of casualties	922
Amphibious warfare, surgical casualties of.....	73
Amputations of lower extremity, physical therapy in aftercare of.....	634
Anesthesia aboard a hospital ship in combat area.....	697
Anesthesia, caudal	163

	PAGE
Anesthesia, caudal, application of to general surgery.....	100
Anesthesia, endotracheal, for dental and oral surgery.....	304
Anesthesia in military medicine.....	105
Anoxia and bend susceptibility, ultraviolet irradiation relative to.....	37
Anticoncussion ear plugs, prevention of aural complications from gunnery concussion	139
Apicoectomy, modified, indications and application in the field.....	729
Appendicitis, acute, surgical vs. medical management of.....	776
Appendicitis, unruptured, ambulatory program following operation for	232
Applicants for naval enlistment, study of albuminuria in.....	321
Army-type litter, method of securing patients to.....	157
Arsenical compounds, toxic effects of, as administered in the U. S. Navy in 1943, with special reference to arsenical dermatitis.....	787
Arthritis, acute, and rheumatic fever as causes for evacuation from South Pacific area.....	1
Aspirator, portable dental.....	374
Atabrin and malaria, hippuric acid liver function test in relation to...	1163
Athlete's foot, campaign against.....	600
Atresia, congenital choanal	1216
Attack transport, 18 months on an.....	513
Attack transport, skin diseases on, treatment of; use of undecylenic acid	1205
Atypical, broncho-, and lobar pneumonia; study of 500 cases.....	438
Aural complications from gunnery concussion, anticoncussion ear plugs in prevention of.....	139
Autoplastic sutures in repair of inguinal hernia.....	83
Aviation cadets, Naval, preliminary bite-wing roentgenographic examination of	901
Avulsion of forearm; report of case.....	1236
Axillary vein, primary thrombosis.....	748
Bacilli, pathogenic enteric; I. Paracolon, proteus and pseudomonas groups	707
Bacilli, pathogenic enteric; II. Salmonella group.....	939
Bacilli, pathogenic enteric; III. Shigella group.....	1178
Bacto-supplement-A, advantages of chocolate agar with, as culture medium; cultivation of the gonococcus.....	409
Bend susceptibility and anoxia, ultraviolet irradiation relative to.....	37
Benzedrine sulfate, daily use of, over a period of 9 years; report of case	1228
Biostatistics in medical research: I. Significant differences.....	1208
Bite infections, human, penicillin in treatment of.....	1020
Bite-wing roentgenographic examination, preliminary, of Naval aviation cadets	901
Blastomycosis of the skin (Gilchrist type) with associated blastomycetic pulmonary disease	333
Blastomycosis, systemic; with a new form of therapy.....	758
Blood elements, normal, and leptospira.....	127
Blood procurement, efficient mass, factors in.....	25
Blood transfusion, indirect, simplified method for.....	766
Book notices.....	167, 383, 572, 780, 1053, 1262
Braces in the field, construction of.....	374

	PAGE
Bracket, toothbrush	567
Brain, spontaneous subarachnoid hemorrhage of, early ophthalmic findings in a case of.....	535
Brain, wounded, method of immobilizing; tantalum in the immediate repair of traumatic skull defects.....	1100
Broncho-, lobar, and atypical pneumonia; study of 500 cases.....	438
Burn, flash, protection.....	381
Burns, flash, prevention of by a protective glove film.....	209
Cadets, Naval aviation, preliminary bite-wing roentgenographic examination of	901
Cadmium, "food poisoning" due to.....	398
Cadmium poisoning; report of outbreak.....	1273
Carbon tetrachloride, hazards of, in present-day use.....	590
Carbon tetrachloride poisoning.....	396
Carpal navicular, fractures of.....	467
Casualties, evacuation of, the LST in; medical problems in amphibious warfare	922
Casualties, psychiatric war, program for the rehabilitation of.....	628
Casualties, reception and treatment of aboard an assault transport....	245
Casualties, surgical, of amphibious warfare.....	73
Caudal anesthesia	163
Caudal anesthesia, application of to general surgery.....	100
Cellulitis of head and neck, x-ray radiation and chemotherapy in treatment of	1200
Cerebral symptoms in malaria.....	1157
Cerebrospinal fever treated with cisternal administration of penicillin.	1023
Cerebrospinal fever, treatment with penicillin.....	281
Chair, dental, as auxiliary operating table.....	565
Chamber, low-pressure, toothache in.....	292
Chancres, multiple; case report.....	137
Chancroid disease, sulfonamide ointment in routine prophylaxis of....	391
Chancroidal infection, experimental prophylaxis and treatment of; inefficacy of penicillin administered intramuscularly.....	189
Chemoprophylaxis, mass	777
Chemotherapy, precision bombing in.....	52
Chemotherapy, pyrotherapy and penicillin in treatment of gonorrhea..	988
Chemotherapy and x-ray radiation in treatment of cellulitis of head and neck	1200
Choanal atresia, congenital.....	1216
Chocolate agar with bacto-supplement-A as culture medium; cultivation of the gonococcus.....	409
Choline hydrochloride in experimental yellow fever in rhesus monkeys.	420
Circumcision, adult, instrument for; suggested changes in.....	1253
Cisternal administration of penicillin in treatment of cerebrospinal fever	1023
Clinic, cystoscopic, at an advance Naval base hospital.....	763
Closure of persistent bronchocutaneous fistula by pedicle muscle graft.	343
Coccidioidomycosis; report of unsuccessful treatment with penicillin...	122
Cold agglutination test, evaluation of, in primary atypical pneumonia.	433
Cold agglutination test; I. Studies on Naval hospital patients; II. Studies on natives in yaws-endemic area.....	1128

	PAGE
Cold hemagglutination test in diagnosis of primary atypical pneumonia	1117
Cold hemagglutinins in infectious mononucleosis.....	717
Colic, reno-ureteral, in South Pacific area.....	80
Collapse of intervertebral disc following spinal puncture.....	666
Combat area, anesthesia aboard a hospital ship in.....	697
Combat, eyeglasses for.....	964
Compression and injection method in processing acrylic dentures.....	297
Congenital choanal atresia.....	1216
Construction of braces in the field.....	372
Contact lens, construction of, for localization of intraocular foreign bodies	1239
Convalescence, planned	611
Convalescent hospital, role of, in a program for the rehabilitation of psychiatric war casualties.....	628
Cosmetic ocular rehabilitation.....	96
Cryptorchidism	1260
Cultivation of the gonococcus; advantages of chocolate agar with bacto-supplement-A as culture medium.....	409
Culture medium, advantages of chocolate agar with bacto-supplement-A as; cultivation of the gonococcus.....	409
Cystoscopic clinic at an advance Naval base hospital.....	763
Debridement unit	555
Defectives, mental, a psychometric procedure for screening.....	316
Dementia praecox, hidden.....	483
Dental aspirator, portable.....	374
Dental chair as auxiliary operating table.....	565
Dental Corps comes of age.....	1145
Dental department on a troop evacuation ship.....	507
Dental offices, shipboard, conserving water in.....	771
Dental and oral surgery, endotracheal anesthesia for.....	304
Dental status of midshipmen; 16th class, U.S.N.R. Midshipmen's School, New York City.....	895
Dental survey in the Marshall Islands.....	1141
Dentistry, operative, thermal stimuli in; control of pain.....	502
Dentures, acrylic, processing; compression and injection method.....	297
Dermatitis, arsenical, in reference to toxic effects of arsenical compounds as administered in the U. S. Navy in 1943.....	787
Dermatitis from blue uniforms.....	754
Dermatologic conditions prevalent in tropical areas; treatment with heavy dosage of ultraviolet ray.....	1193
Dermatologic practice in South Pacific.....	17
Desensitization and sensitization to mercury; complications following tattooing	889
Destroyers, wardroom operating table for.....	1044
Determining specific gravity of man by spirometer method.....	288
Device, exercising, for increasing joint action.....	559
Diaphragmatic pleurodynia, epidemic; an outbreak.....	664
Differentiation of tissues by filtered ultraviolet light.....	379
Diseases, infectious, low incidence of, at secondary training center.....	114
Diver, aero-embolism in.....	538

	PAGE
Donor, safe universal.....	32
Donor set, improvised, for giving indirect transfusions.....	1251
Draftees, Navy, malingering among, low incidence of.....	737
Dye delineation of sinus tracts.....	166
Dystrophy, progressive muscular.....	129
Ear plugs, anticoncussion, prevention of aural complications from gun- nery concussion	139
Electromagnet, aiding passage of Miller-Abbott tube through pylorus.	463
Embolism, air, in immersion blast.....	871
Emergency poison kit.....	154
Emergency surgical spotlight.....	562
Emphysema, mediastinal; report of 2 cases.....	119
Empyema following lobar pneumonia, penicillin in treatment of.....	353
Empyema thoracis, postpneumonic, complicating sulfonamide-treated pneumonia	46
Endocarditis, subacute bacterial, successfully treated with penicillin...	1010
Endotracheal anesthesia for dental and oral surgery.....	304
Enlistment, Naval, applicants for, study of albuminuria in.....	321
Eenteric bacilli, pathogenic; I. Paracolon, proteus and pseudomonas groups	707
Enteric bacilli, pathogenic; II. Salmonella group.....	939
Enteric bacilli, pathogenic; III. Shigella group.....	1178
Epidemic diaphragmatic pleurodynia; an outbreak.....	664
Epidemic of food infection caused by Salmonella montevideo.....	1067
Epidemic jaundice in Tunisia, investigation of.....	579
Epidemic, septic sore throat; food infection.....	1277
Epidemic in Southwest Pacific of scrub typhus.....	645
Epidemics, food poisoning, prevention of.....	393
Evacuation, aerial, of thoracic wounded; consideration of effect of altitude	685
Evacuation of casualties, the LST in; medical problems in amphibious warfare	922
Evacuation ship, troop, dental department on.....	507
Evacuation from South Pacific area, rheumatic fever and acute arthri- tis as causes for.....	1
Examination, preliminary bite-wing roentgenographic, of Naval avia- tion cadets	901
Examinations, gastroscopic, study of 191; gastric diseases in Navy personnel	450
Examining, selection, experiment in psychotherapy during.....	39
Exercising device for increasing joint action.....	559
Extremities, wounded, refrigeration of.....	1041
Extremity, lower, adherent scars of the.....	878
Extremity, lower, amputations of, physical therapy in aftercare of....	634
Eye replacement by acrylic maxillofacial prosthesis.....	1085
Eyeglasses for combat.....	964
Fatigue-stress fractures; diverse anatomic location and similarity to malignant lesions	674
Feet, management of fungus infection of.....	525
Fever curing impetigo contagiosa.....	136
Field, construction of braces in.....	374

	PAGE
Field, indications and application in the field of a modified apicoectomy	729
Field, method for individual transportation of plasma in the.....	1038
Field, method of obtaining suction in.....	150
Field, working rules in	253
Filarial problem on Nanumea.....	955
Filariasis; clinical findings in 189 cases.....	950
Filariasis, early, genital manifestations of.....	263
Film, protective glove, in prevention of flash burns.....	209
Film, x-ray, method of processing under tropical conditions.....	160
First-aid kit, life raft.....	1256
Fistula, persistent bronchocutaneous, closure of by pedicle muscle graft	343
Flash-burn protection	381
Flash burns, prevention of by a protective glove film.....	209
Flying suit to aid in control of hemorrhage.....	366
Food infection, epidemic of, caused by <i>Salmonella montevideo</i>	1067
Food infection; septic sore throat epidemic.....	1277
"Food poisoning" from cadmium.....	398
Food poisoning epidemics, prevention of.....	393
Food poisoning and respiratory disease.....	1282
Food and wound healing.....	1051
Forearm, avulsion of; report of case.....	1236
Foreign bodies, intraocular, localization of; construction of contact lens for	1239
Foreign body localization.....	363
Fractures of articular facets and subluxations of apophyseal joints...	234
Fractures of the carpal navicular.....	467
Fractures, fatigue-stress; diverse anatomic location and similarity to malignant lesions	674
Fractures of hand and wrist, skeletal traction in.....	477
Fungus infection of the feet, management of.....	525
Gangrene, gas	569
Gas gangrene	569
Gastric diseases in Navy personnel; study of 191 gastroscopic examinations	450
Gastro-intestinal department at Naval hospitals, effective management of	459
Gastroscopic examinations, study of 191; gastric diseases in Navy personnel	450
Genital manifestations of early filariasis.....	263
Gilchrist type of blastomycosis of the skin, with associated blastomycetic pulmonary disease.....	333
Gonococcal urethritis, posterior.....	278
Gonococcus, cultivation of; advantages of chocolate agar with bacto-supplement-A as culture medium.....	409
Gonococcus infections and rheumatic fever, penicillin in treatment of..	1001
Gonorrhea with associated undiagnosed early syphilis, penicillin therapy in	1031
Gonorrhea, sulfonamide-resistant, penicillin in.....	997
Gonorrhea, sulfonamide-resistant, penicillin in; preliminary report of 124 cases	423

	PAGE
Gonorrhea, sulfonamide-resistant, results of penicillin treatment of....	193
Gonorrhea, treatment of, by chemotherapy, pyrotherapy and penicillin.	988
Gonorrheal ophthalmia	532
Gonorrheal urethritis, early use of sounds for.....	967
Gonorrheal urethritis, parafrenal abscess complication of.....	543
Graft, pedicle muscle, in closure of persistent bronchocutaneous fistula.	343
Granulocytopenia, malignant, penicillin in.....	1017
Guillain-Barré syndrome (acute ascending paralysis).....	4
Gunnery concussion, prevention of aural complications from.....	139
Hand and wrist, fractures of, skeletal traction in.....	477
Hazards of carbon tetrachloride in present-day use.....	590
Health of the Navy.....	197, 1283
Heat, prickly, psoriasis following.....	762
Hemagglutination test, cold, in diagnosis of primary atypical pneumonia	1117
Hemagglutinins, cold, in infectious mononucleosis.....	717
Hemoglobinuria following plasmochin therapy.....	1232
Hemorrhage, control of, flying suit to aid in.....	366
Hemorrhage into nail bed, simple treatment for.....	371
Hemorrhage, spontaneous subarachnoid, of brain, early ophthalmic findings in case of.....	535
Hemothorax, traumatic	1107
Hepatitis, acute, and acute infective jaundice.....	1166
Hepatitis, acute infectious.....	271
Hernia, inguinal, autoplasic sutures in repair of.....	83
Herpes zoster with motor involvement.....	357
Hippuric acid liver function test in relation to malaria and atabrin...	1163
Hospital, advance Naval base, cystoscopic clinic at.....	763
Hospital, convalescent, role of in program for the rehabilitation of psychiatric war casualties.....	628
Hospital ship in amphibious action.....	937
Hospital ship, anesthesia aboard in combat area.....	697
Human bite infections, penicillin in treatment of.....	1020
Hypodermic syringe, protector sleeve for.....	147
Idiopathic porphyria, acute.....	349
Illustration, medical	970
Immersion blast, air embolism in.....	871
Immobilizing the wounded brain, method of; tantalum in the immediate repair of traumatic skull defects.....	1100
Impetigo contagiosa cured by fever.....	136
Improvised donor set for giving indirect transfusions.....	1251
Improvised metal pins for skeletal transfixion.....	1036
Incidence, low, of malingering among Navy draftees.....	737
Indirect blood transfusion, simplified method for.....	766
Indirect transfusions, improvised donor set for.....	1251
Individual transportation of plasma in the field, method for.....	1038
Inductees, Naval, psychoses in, with less than 15 days' active duty; need for early elimination of potentially psychotic.....	909
Infection, chancroidal, experimental prophylaxis and treatment of; inefficacy of penicillin administered intramuscularly.....	189
Infection, food, epidemic of, caused by <i>Salmonella montevideo</i>	1067

	PAGE
Infection, food; septic sore throat epidemic.....	1277
Infection, fungus, of the feet, management of.....	525
Infections, human bite, penicillin in treatment of.....	1020
Infections, meningococcic	650
Infectious diseases, low incidence of, at secondary training center.....	114
Infectious hepatitis, acute.....	271
Infectious mononucleosis, cold hemagglutinins in.....	717
Infectious polyneuritis; report of 4 cases.....	13
Inflammation of the macula lutea.....	133
Inguinal hernia, autoplasic sutures in repair of.....	83
Injection and compression method in processing acrylic dentures.....	297
Injectionist or surgeon.....	164
Instrument for adult circumcision, suggested changes in.....	1253
Intervertebral disc, collapse of, following spinal puncture.....	666
Intramuscular administration of penicillin, inefficacy of; experimental prophylaxis and treatment of chancroidal infection.....	189
Intraocular foreign bodies, localization of; construction of contact lens for	1239
Invalidings from the service for causes existing prior to enlistment; Women's Reserves	490
Iridocyclitis, severe, treated with penicillin.....	546
Irradiation, ultraviolet, relative to anoxia and bend susceptibility.....	37
Irrigating syringe, quick-filling.....	563
Jaundice, acute infective, and acute hepatitis.....	1166
Jaundice epidemic in Tunisia, investigation of.....	579
Joint action, exercising device for increasing.....	559
Kent Battery, experiences in use of.....	44
Kidneys, polycystic diseases of.....	223
Kit, emergency poison.....	154
Kit, first-aid, life raft.....	1256
Knee injuries in service personnel.....	63
Kodachrome photography, maxillofacial.....	495
LST in evacuation of casualties; medical problems in amphibious warfare	922
Labor board, medical department of.....	175
Lens, contact, construction of, for localization of intraocular foreign bodies	1239
Leptospira and normal blood elements.....	127
Lesions, malignant, diverse anatomic location and similarity to fatigue-stress fractures	674
Lesions, primary syphilitic, effects of subtherapeutic dose of penicillin on development of.....	1034
Life raft first-aid kit.....	1256
Lift, universal two-litter.....	376
Lingua nigra, report of case.....	360
Litter, Army-type, method of securing patients to.....	157
Litter lift, universal 2-.....	376
Liver function test, hippuric acid, in relation to malaria and atabrin..	1163
Liver involvement in malaria.....	847
Lobar, broncho-, and atypical pneumonia; study of 500 cases.....	438
Lobar pneumonia, penicillin in treatment of empyema following.....	353

	PAGE
Localization, foreign body.....	363
Localization of intraocular foreign bodies; construction of contact lens for	1239
Lock, safety, for folding field operating table.....	1047
Low back pain; subluxations of apophyseal joints and fractures of articular facets	234
Low incidence of malingering among Navy draftees.....	737
Low-pressure chamber, toothache in.....	292
Macula lutea, inflammation of.....	133
Malaria and atabrin, hippuric acid liver function test in relation to....	1163
Malaria, cerebral symptoms in.....	1157
Malaria, liver involvement in.....	847
Malaria, observations on.....	1171
Malaria, relapsing, analysis of cases from the Solomons.....	859
Malarial spleen, spontaneous rupture of.....	743
Malignant granulocytopenia, penicillin in.....	1017
Malignant lesions, diverse anatomic location and similarity to fatigue- stress fractures	674
Malingering among Navy draftees, low incidence of.....	737
Marginal paradentosis in Naval personnel, treatment of.....	720
Marshall Islands, dental survey in.....	1141
Mass chemoprophylaxis	777
Maxillofacial kodachrome photography.....	495
Maxillofacial prosthesis, acrylic, in eye replacement.....	1085
Mediastinal emphysema; report of 2 cases.....	119
Medical department of a labor board.....	175
Medical experiences on an APD.....	930
Medical illustration	970
Medical problems in amphibious warfare; the LST in evacuation of casualties	922
Medical research, biostatistics in: I. Significant differences.....	1208
Medical vs. surgical management of acute appendicitis.....	776
Medium, culture, advantages of chocolate agar with bacto-supple- ment-A as; cultivation of the gonococcus.....	409
Meningococcic infections	650
Mental defectives, screening of, psychometric procedure for.....	316
Mental mechanisms and morale factors of Naval recruits in training..	1137
Mental nerve, neurinoma of.....	125
Mercury, sensitization and desensitization to; complications following tattooing	889
Method, simplified, for indirect blood transfusion.....	766
Micraform sulfathiazole, evaluation of, in treatment of paradentosis (pyorrhea alveolaris)	59
Midshipmen, dental status of; 16th class, U.S.N.R. Midshipmen's School, New York City.....	895
Military medicine, anesthesia in.....	105
Military service, achalasia in; treatment and disposition.....	1111
Miller-Abbott tube, passage of, through pylorus with aid of electro- magnet	463
Mobile surgery unit for amphibious operations.....	552
Mobile surgical unit setup.....	773

	PAGE
Monkeys, rhesus, choline hydrochloride in experimental yellow fever in	420
Mononucleosis, infectious, cold hemagglutinins in.....	717
Morale factors and mental mechanisms of Naval recruits in training..	1137
Motor involvement in herpes zoster.....	857
Muscle, pedicle, graft, in closure of persistent bronchocutaneous fistula.	343
Muscular dystrophy, progressive.....	129
Nail bed, simple treatment for hemorrhage into.....	371
Nanumea atoll, yaws survey on.....	739
Nanumea, filarial problem on.....	955
Natives in yaws-endemic area, studies on; cold agglutination test.....	1128
Naval aviation cadets, preliminary bite-wing roentgenographic examination of	901
Naval enlistment, applicants for, study of albuminuria in.....	321
Naval hospital, occupational therapy in.....	325
Naval hospitals, effective management of gastro-intestinal department at	459
Naval inductees, psychoses in, with less than 15 days' active duty; need for early elimination of potentially psychotic.....	909
Naval personnel, treatment of marginal paradentosis in.....	720
Naval recruits in training, mental mechanisms and morale factors of..	1137
Navy draftees, malingering among, low incidence of.....	737
Navy, health of.....	197, 1283
Navy personnel, gastric diseases in; study of 191 gastroscopic examinations	450
Nerve, mental, neurinoma of.....	125
Neurinoma of the mental nerve.....	125
Night vision test.....	143
Nodosa, periarteritis.....	1220
Notes on our Reserve contributors.....	199, 401, 603, 840, 1074, 1284
Occupational therapy in a Naval hospital.....	325
Ocular cosmetic rehabilitation.....	96
Ocular prosthesis, acrylic.....	1258
Ointment, sulfonamide, in routine prophylaxis of chancroid disease....	391
Operating table, auxiliary, dental chair as.....	565
Operating table, combination shipboard; for general, orthopedic and urologic surgery	1243
Operating table, folding field, safety lock for.....	1047
Operating table, wardroom, for destroyers.....	1044
Operative dentistry, thermal stimuli in; control of pain.....	502
Ophthalmia, gonorrheal.....	532
Ophthalmic findings in a case of spontaneous subarachnoid hemorrhage of brain	535
Oral and dental surgery, endotracheal anesthesia for.....	304
Oxygen regulator, dual diluter demand.....	368
Pain, control of; thermal stimuli in operative dentistry.....	502
Pain, recurrent abdominal, amebiasis as cause of.....	527
Pain relief	504
Paracolon, proteus and pseudomonas groups; pathogenic enteric bacilli.	707
Paradentosis, marginal, in Naval personnel, treatment of.....	720
Paradentosis (pyorrhea alveolaris), evaluation of microform sulfathiazole in treatment of.....	59

	PAGE
Parafrenal abscess, complication of gonorrheal urethritis.....	543
Paralysis, acute ascending (Guillain-Barré syndrome).....	4
Pathogenic enteric bacilli; I. Paracolon, proteus and pseudomonas groups	707
Pathogenic enteric bacilli; II. Salmonella group.....	939
Pathogenic enteric bacilli; III. Shigella group.....	1178
Patient, surgical, early ambulation of.....	380
Patients, Naval hospital, studies on; cold agglutination test.....	1228
Patients, psychiatric, transferred to the United States from an overseas base	311
Pedicle muscle graft in closure of persistent bronchocutaneous fistula..	343
Penicillin	1048
Penicillin, cisternal administration of in treatment of cerebrospinal fever	1023
Penicillin, failure of, to prevent syphilis.....	389
Penicillin, inefficacy of, administered intramuscularly in experimental prophylaxis and treatment of chancroidal infection.....	189
Penicillin in malignant granulocytopenia.....	1017
Penicillin, pyrotherapy and chemotherapy in treatment of gonorrhea..	988
Penicillin; report of unsuccessful treatment with, in coccidioidomycosis	122
Penicillin, severe iridocyclitis treated with.....	546
Penicillin, subtherapeutic dose, effects of, on development of primary syphilitic lesion	1034
Penicillin in successful treatment of subacute bacterial endocarditis...	1010
Penicillin in sulfonamide-resistant gonorrhea.....	997
Penicillin in sulfonamide-resistant gonorrhea; preliminary report of 124 cases	423
Penicillin therapy in gonorrhea with associated undiagnosed early syphilis	1031
Penicillin therapy in phagedenic ulcer (tropical sloughing phagedena)	981
Penicillin in treatment of agranulocytosis.....	1014
Penicillin, treatment of cerebrospinal fever with.....	281
Penicillin in treatment of empyema following lobar pneumonia.....	353
Penicillin in treatment of human bite infections.....	1020
Penicillin in treatment of primary atypical pneumonia.....	974
Penicillin in treatment of rheumatic fever and gonococcus infections..	1001
Penicillin treatment of sulfonamide-resistant gonorrhea.....	193
Penicillin in treatment of yaws.....	1025
Periarteritis nodosa.....	1220
Personnel, Naval, treatment of marginal paradentosis in.....	720
Personnel, Navy, gastric diseases in; study of 191 gastroscopic examinations	450
Personnel, service, knee injuries in.....	63
Pes cavus, bilateral.....	346
Phagedenic ulcer (tropical sloughing phagedena), penicillin therapy in	981
Photography, maxillofacial kodachrome.....	495
Physical therapy in aftercare of amputations of lower extremity.....	634
Pins, improvised metal, for skeletal transfixion.....	1036
Planned convalescence	611
Plasma in the field, method for individual transportation of.....	1038
Plasmochin therapy, hemoglobinuria following.....	1232

	PAGE
Pleurodynia, epidemic diaphragmatic; an outbreak.....	664
Pneumonia, lobar, broncho- and atypical; study of 500 cases.....	438
Pneumonia, lobar, penicillin in treatment of empyema following.....	353
Pneumonia, primary atypical, evaluation of the cold agglutination test in	433
Pneumonia, primary atypical, penicillin in treatment of.....	974
Pneumonia, primary atypical and streptococcus MG.....	1049
Pneumonia, sulfonamide-treated, complicated by postpneumonic empy- ema thoracis	46
Poison kit, emergency.....	154
Poisoning, cadmium; report of outbreak.....	1273
Poisoning, carbon tetrachloride	396
"Poisoning, food," due to cadmium.....	398
Poisoning, food, epidemics, prevention of.....	393
Poisoning, food, and respiratory disease.....	1282
Poisoning, sodium fluoride.....	551
Polycystic disease of the kidneys.....	223
Polyneuritis, infectious; report of 4 cases.....	13
Porphyria, idiopathic, acute.....	349
Portable dental aspirator.....	374
Postcholecystectomy syndrome.....	568
Posterior gonococcal urethritis.....	278
Postpneumonic empyema thoracis complicating sulfonamide-treated pneumonia	46
Prickly heat, psoriasis following.....	762
Primary atypical pneumonia, cold hemagglutination test in diagnosis of	1117
Primary atypical pneumonia, evaluation of the cold agglutination test in	433
Primary atypical pneumonia, penicillin in treatment of.....	974
Primary atypical pneumonia and streptococcus MG.....	1049
Primary axillary vein thrombosis.....	748
Procaine hydrochloride 4-percent, indications for use.....	111
Processing acrylic dentures; compression and injection method.....	297
Processing x-ray film under tropical conditions.....	160
Program, general rehabilitation, role of psychiatrist in.....	621
Program for the rehabilitation of psychiatric war casualties.....	628
Prophylaxis of chancroid disease, sulfonamide ointment in.....	391
Prophylaxis and treatment of chancroidal infection, inefficacy of peni- cillin administered intramuscularly.....	189
Prophylaxis, venereal, sulfa-mercury compound for.....	1063
Prosthesis, acrylic maxillofacial, in eye replacement.....	1085
Prosthesis, acrylic ocular.....	1258
Protection, flash-burn.....	381
Protective glove film in prevention of flash burns.....	209
Protector sleeve for hypodermic syringe.....	147
Proteus, paracolon and pseudomonas groups; pathogenic enteric bacilli.	707
Pseudomonas, paracolon and proteus groups; pathogenic enteric bacilli	707
Psoriasis following prickly heat.....	762
Psychiatric patients transferred to the United States from an overseas base	311

	PAGE
Psychiatric war casualties, program for the rehabilitation of.....	628
Psychiatrist, role of, in the general rehabilitation program.....	621
Psychometric procedure for screening mental defectives.....	316
Psychoses in Naval inductees with less than 15 days' active duty; need for early elimination of potentially psychotic.....	909
Psychotherapy, experiment in, during selection examining.....	39
Pterygium transplantation by simplified method.....	1114
Pulmonary disease, blastomycetic, with blastomycosis of the skin (Gilchrist type).....	333
Pylorus, passage of Miller-Abbott tube through, with aid of electromagnet	463
Pyorrhea alveolaris (paradentosis), evaluation of microform sulfathiazole in treatment of.....	59
Pyrotherapy, chemotherapy and penicillin in treatment of gonorrhea..	988
Raft, life, first-aid kit.....	1256
Reaction, sulfonamide, case of.....	355
Reception and treatment of casualties aboard an assault transport....	245
Recruits, Naval, in training, mental mechanisms and morale factors of	1137
Refrigeration of wounded extremities.....	1041
Regulator, oxygen, dual diluter demand.....	368
Rehabilitation	775
Rehabilitation, cosmetic ocular.....	96
Rehabilitation program, general, role of the psychiatrist in.....	621
Rehabilitation of psychiatric war casualties, program for.....	628
Relapsing malaria; analysis of cases from the Solomons.....	859
Relief, pain.....	504
Reno-ureteral colic in South Pacific area.....	80
Repair, tendon.....	241
Repair of traumatic skull defects, tantalum in; method of immobilizing the wounded brain.....	1100
Replacement, eye, by acrylic maxillofacial prosthesis.....	1085
Research, medical, biostatistics in: I. Significant differences.....	1208
Respiratory disease and food poisoning.....	1282
Restorations, acrylic, fixed anterior.....	301
Rheumatic fever and acute arthritis as causes for evacuation from South Pacific area.....	1
Rheumatic fever and gonococcus infections, penicillin in treatment of..	1001
Roentgenographic examination, preliminary bite-wing, of Naval aviation cadets.....	901
Rules, working, in the field.....	253
Rupture, spontaneous, of the malarial spleen.....	743
Rupture, traumatic, of the spleen.....	216
Safety lock for folding field operating table.....	1047
Salmonella group, pathogenic enteric bacilli.....	939
Salmonella montevideo, epidemic of food infection caused by.....	1067
Scars, adherent, of the lower extremity.....	878
Screening mental defectives, psychometric procedure for.....	316
Scrub typhus; note on taxonomy of type species of the mite genus Trombicula berlese.....	837
Scrub typhus; report of epidemic in Southwest Pacific.....	645
Selection examining, experiment in psychotherapy during.....	39

	PAGE
Sensitization and desensitization to mercury; complications following tattooing	889
Septic sore throat epidemic; food infection.....	1277
Shigella group, pathogenic enteric bacilli.....	1178
Ship, hospital, in amphibious action.....	937
Ship, hospital, anesthesia aboard in combat area.....	697
Shipboard dental offices, conserving water in.....	771
Shipboard operating table, combination; for general, orthopedic and urologic surgery.....	1243
Sinus tracts, dye delineation of.....	166
Skeletal traction in fractures of hand and wrist.....	477
Skeletal transfixion, improvised metal pins for.....	1036
Skin, blastomycosis of, (Gilchrist type) with associated blastomycetic pulmonary disease	333
Skin diseases on an attack transport, treatment of; use of undecylenic acid	1205
Skin diseases in the tropics.....	1258
Sling, time-saving combination.....	557
Sodium fluoride poisoning.....	551
Solomons, analysis of cases of relapsing malaria from.....	859
Sounds, early use of, for gonorrheal urethritis.....	967
South Pacific area, reno-ureteral colic in.....	80
South Pacific area, rheumatic fever and acute arthritis as causes for evacuation from	1
South Pacific, dermatologic practice in.....	17
Southwest Pacific, report of epidemic of scrub typhus in.....	645
Specific gravity of man, determining of, by spirometer method.....	288
Spinal puncture, collapse of intervertebral disc following.....	666
Spirometer method for determining specific gravity of man.....	288
Spleen, malarial, spontaneous rupture of.....	743
Spleen, traumatic rupture of.....	216
Spotlight, emergency surgical.....	562
Stimulation, temporary, of emmetropic visual acuity.....	90
Streptococcus MG and primary atypical pneumonia.....	1049
Subacute bacterial endocarditis successfully treated with penicillin....	1010
Subarachnoid hemorrhage of brain, spontaneous, early ophthalmic findings in case of.....	535
Subluxations of apophyseal joints and fractures of articular facets....	234
Suction in the field, methods of obtaining.....	150
Suit, flying, to aid in control of hemorrhage.....	366
Sulfa-mercury compound for venereal prophylaxis.....	1063
Sulfathiazole, micraform, evaluation of, in treatment of paradentosis (pyorrhea alveolaris)	59
Sulfonamide ointment in routine prophylaxis of chancroid disease.....	391
Sulfonamide reaction, case of.....	355
Sulfonamide-resistant gonorrhea, penicillin in.....	997
Sulfonamide-resistant gonorrhea, penicillin in; preliminary report of 124 cases	423
Sulfonamide-resistant gonorrhea, results of penicillin treatment of....	193
Sulfonamide-treated pneumonia complicated by postpneumonic empyema thoracis.....	46

	PAGE
Surgeon or injectionist.....	164
Surgery, general, application of caudal anesthesia to.....	100
Surgery, general, orthopedic and urologic; combination shipboard operating table for.....	1243
Surgery, oral and dental, endotracheal anesthesia for.....	304
Surgery unit, mobile, for amphibious operations.....	552
Surgical casualties of amphibious warfare.....	73
Surgical patient, early ambulation of.....	380
Surgical spotlight, emergency.....	562
Surgical unit setup, mobile.....	773
Surgical vs. medical management of acute appendicitis.....	776
Survey, dental, in the Marshall Islands.....	1141
Sutures, autoplasmic, in repair of inguinal hernia.....	83
Syndrome, postcholecystectomy.....	568
Syphilis, associated undiagnosed early, in gonorrhea; penicillin therapy in	1031
Syphilis, failure of penicillin to prevent.....	389
Syphilis, primary and secondary, treatment of, modified intensive method for.....	429
Syphilitic lesion, primary, effects of subtherapeutic dose of penicillin on development of.....	1034
Syringe, quick-filling irrigating.....	563
Systemic blastomycosis; with a new form of therapy.....	758
Tantalum in the immediate repair of traumatic skull defects; method of immobilizing the wounded brain.....	1100
Tattooing, complications following; sensitization and desensitization to mercury	889
Tendon repair	241
Test, cold agglutination, evaluation of in primary atypical pneumonia..	433
Test, cold agglutination; I. Studies on Naval hospital patients; II. Studies on natives in yaws-endemic area.....	1128
Test, hippuric acid liver function, in relation to malaria and atabrin..	1163
Test, night vision.....	143
Therapy, occupational, in a Naval hospital.....	325
Therapy, physical, in aftercare of amputations of lower extremity....	634
Thermal stimuli in operative dentistry; control of pain.....	502
Thoracic wounded, aerial evacuation of; consideration of effect of altitude	685
Thrombosis, primary axillary vein.....	748
Tissues, differentiation of by filtered ultraviolet light.....	379
Toothache in low pressure chamber.....	292
Toothbrush bracket	567
Toxic effects of arsenical compounds as administered in the U. S. Navy in 1943, with special reference to arsenical dermatitis.....	787
Traction, skeletal, in fractures of hand and wrist.....	477
Training center, secondary, low incidence of infectious diseases at....	114
Transfusion, indirect blood, simplified method for.....	766
Transfusion, indirect, improvised donor set for.....	1251
Transplantation, pterygium, by simplified method.....	1114
Transport, assault, reception and treatment of casualties aboard.....	245
Transport, attack, 18 months on an.....	513

	PAGE
Transport, attack, skin diseases on, treatment of; use of undecylenic acid	1205
Transportation, individual, of plasma in the field, method for.....	1038
Traumatic hemothorax.....	1107
Traumatic rupture of the spleen.....	216
Traumatic skull defects, tantalum in the immediate repair of; method of immobilizing the wounded brain.....	1100
Treatment of primary and secondary syphilis, modified intensive method for.....	429
Treatment and reception of casualties aboard an assault transport....	245
Trench mouth aboard a United States Naval auxiliary vessel.....	308
Trombicula berlese, mite genus, note on taxonomy of type species of the Troop evacuation ship, dental department on.....	837
	507
Tropical areas, dermatologic conditions in; treatment with heavy dosage of ultraviolet ray.....	1193
Tropical conditions, method of processing x-ray film under.....	160
Tropical sloughing phagedena (phagedenic ulcer), penicillin therapy in	981
Tropics, skin diseases in	1258
Tsutsugamushi disease	800
Tsutsugamushi disease; note on taxonomy of type species of the mite genus Trombicula berlese.....	837
Tunisia, investigation of jaundice epidemic in.....	579
Typhus, scrub; note on taxonomy of type species of the mite genus Trombicula berlese.....	837
Typhus, scrub; report of epidemic in Southwest Pacific.....	645
Ulcer, phagedenic (tropical sloughing phagedena), penicillin therapy in	981
Ultraviolet irradiation relative to anoxia and bend susceptibility.....	37
Ultraviolet light, filtered, in differentiation of tissues.....	379
Ultraviolet ray, heavy dosage of, in treatment of dermatologic conditions prevalent in tropical areas.....	1193
Undecylenic acid, use of, in treatment of skin diseases on an attack transport	1205
Uniforms, blue, dermatitis from.....	754
Unit, debridement	555
Unit, mobile surgery, for amphibious operations.....	552
Unit, mobile surgical, setup.....	773
U.S.N.R. Midshipmen's School, New York City, 16th class; dental status of midshipmen.....	895
Universal donor, safe.....	32
Urethritis, gonorrheal, early use of sounds for.....	967
Urethritis, gonorrheal, parafrenal abscess as complication of.....	543
Urethritis, posterior gonococcal.....	278
Vein, primary axillary, thrombosis of.....	748
Venereal prophylaxis, sulfa-mercury compound for.....	1063
Vision, night, test.....	143
Visual acuity, emmetropic, temporary stimulation of.....	90
War casualties, psychiatric, program for the rehabilitation of.....	628
Wardroom operating table for destroyers.....	1044
Warfare, amphibious, medical problems in; the LST in evacuation of casualties	922
Warfare, amphibious, surgical casualties of.....	73

	PAGE
Water, conserving, in shipboard dental offices.....	771
Waterhouse-Friderichsen syndrome, report of case.....	547
Women's Reserves; invalidings from the service for causes existing prior to enlistment.....	490
Working rules in the field.....	253
Wound healing and food.....	1051
Wounded extremities, refrigeration of.....	1041
Wounded, thoracic, aerial evacuation of; consideration of effect of alti- tude	685
Wrist and hand, fractures of, skeletal traction in.....	477
X-ray film, processing under tropical conditions.....	160
X-ray radiation and chemotherapy in treatment of cellulitis of head and neck	1200
Yaws-endemic area, natives in, studies on; cold agglutination test....	1128
Yaws survey on Nanumea atoll.....	739
Yaws treated with penicillin.....	1025
Yellow fever, experimental, in rhesus monkeys, choline hydrochloride in.	420

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 43

INDEX TO AUTHORS

	PAGE		PAGE
Allan, John H.....	63	Brunnstrom, Signe.....	634
Allen, Ralph F.....	127	Brunson, Forrest M.....	1253
Ames, Richard H.....	1251	Buhler, Victor B.....	1193
Amyot, Bruno E.....	125	Burhans, Robert A.....	278
Anderson, Laura T.....	787	Cameron, Markley C.....	562
Anderson, Truman O.....	147, 563	Carleton, William T.....	459
Arje, Sidney L.....	150	Carmody, John T. B.....	1157
Arling, Philip A.....	281	Carpenter, Cedric C.....	389, 754
Ashburn, Frank S.....	552	Carter, T. J.....	787
Baer, Louis Shattuck.....	127, 393	Cenac, Phillip L.....	122
Baer, Rudolf L.....	889	Chambers, Wesley M.....	787
Baganz, Crawford N.....	1137	Chiles, George G.....	83
Bakst, Henry J.....	1228	Clarke, Burdick G.....	1256
Baldree, Charles E., Jr.....	555	Climer, James E.....	937
Banzer, John W., Jr.....	754	Closson, James H.....	39
Barnes, LaVerne A.....	707, 939, 1178	Coburn, Alvin F.....	52
Bean, Lawrence L.....	143	Cohen, Maynard I.....	1166
Beneventi, Francis A.....	967	Cohen, Robert A.....	628
Benjamin, H. B.....	114	Cole, Gillon M.....	393
Benkwith, Karl B.....	535	Cole, Thomas C.....	241
Benson, Clifford D.....	46, 343	Conley, James E.....	100
Berger, Edmund H.....	450	Cowart, James T.....	119
Binder, Clifford F.....	590	Cox, Lawrence K.....	139
Bingham, Charles T.....	17	Cuono, Joseph D.....	1107
Blaess, Marvin J.....	96	Cuttle, Tracy D.....	922
Blalock, Tully T.....	129	Davidson, William M.....	37, 368
Blute, James F., Jr.....	1063	Davin, Thomas W.....	301
Bonsole, Harold Y. D.....	557	Delaney, C. Joseph.....	1020
Boyd, Greydon G.....	1034	Dement, Donald E.....	773
Braceland, Francis J.....	621	Dennis, Robert L.....	988
Bradley, James L.....	59, 720	Derzavis, Jack L.....	600
Braun, Gustave S.....	346	DiLeo, Lucian W.....	137
Brickman, I. W.....	292	Doran, Robert E.....	674
Brinkerhoff, Albert J.....	133	Douglas, Albert H. R.....	1017
Bruce, Norman H.....	748	Downing, F. Harold.....	666

	PAGE		PAGE
Drummond, William A., Jr.....	44	Hildreth, Harold M.....	39, 316, 483
Dunning, James M.....	895	Hill, Joel M.....	483
Dynes, John B.....	628	Hipps, Herbert E.....	467
Ebeling, Walter W.....	477	Hobby, Albert W.....	438
Eckles, Lucius E.....	1067	Hodges, Francis T.....	1273
Edge, Cary O.....	193	Hoffman, Richard R.....	1111
Engel, Milton B.....	502	Holman, Emile.....	253
Ewing, H. E.....	837	Holmes, Samstone.....	374
Farner, Donald S.....	800	Hubbard, John D.....	1253
Farquhar, John C.....	111	Hughens, Hardy V.....	325
Fauley, Gordon B.....	209	Humphrey, Arthur A.....	349, 1117
Ferguson, L. Kraeer.....	73, 697, 1014	Huntington, Robert W., Jr.....	263
Fetter, Ferdinand.....	349	Ivy, A. C.....	209
Fetterman, George H.....	1128	Janetos, Dion S.....	308
Filberbaum, Milton B.....	547	Johnson, Paul A. G.....	950
Fink, Harold.....	1017	Johnson, William B., Jr.....	304
Fishman, Jack.....	758	Jones, John P.....	717
Fitzgerald, Patrick J.....	4	Kanof, Abram.....	889
Fleming, Justus M.....	1047	Katsampes, Chris P.....	800
Flynn, Stephen E.....	353	Keck, Alfred J.....	301
Fogel, R. Harwood.....	263	Kelly, Francis T.....	137
Foley, Frank A.....	371	Kern, Richard A.....	847
Foote, John J.....	1041	Kerr, Richard K.....	232
Friedrich, Eduard Georg.....	297	Klotz, Ben.....	543
Gardner, W. James.....	1100	Knapp, Arthur Alexander.....	964
Geller, John W.....	139	Lambrakis, James G.....	1277
Genauer, Mortimer B.....	105	Landy, Simeon.....	189
Gerber, Marvin L.....	363	Larson, Albert B.....	507
Gershon-Cohen, J.....	674	Lauer, Calvin A.....	232
Gevurtz, William S.....	930	Leach, William F.....	366
Gezon, Horace M.....	579	Lebensohn, James E.....	90
Gillespie, Barnes.....	245	Leberman, Paul R.....	409
Glauser, Frank.....	525	LeFevre, Ira D.....	739
Glazier, McCleery.....	80	Legge, Robert F.....	1236
Goldman, Alfred.....	685	Leiter, Samuel S.....	223
Goodale, Raymond H.....	1277	Lemmon, G. Bruce, Jr.....	357
Gouze, Frank J.....	288, 538, 871	Lenhardt, Harry F.....	83
Greene, Oscar.....	136, 551	Little, Raymond D.....	360
Gurley, Lycurgus M., Jr.....	1114	Loe, Ralph H.....	450
Hall, Henry H.....	565	Lofgren, Robert C.....	1025
Hamilton, Francis J.....	628	Logan, Victor W.....	271
Hamm, William G.....	981	Logue, Joseph B.....	645
Harner, Clyde E.....	546	Longenecker, Charles R.....	349
Harris, Daniel H.....	737	Lowman, Edward W.....	611
Harris, Herbert I.....	13	Lufkin, Nathaniel H.....	1273
Harris, John D.....	44	Lulow, William V.....	114
Hayter, Robert.....	288, 871	Lutz, Francis C.....	557
Heintzelman, John H. L.....	433	Luykx, H. M. C.....	1208
Hess, William R.....	1128	McCann, Walter J.....	1205
Hewson, George F.....	1034	McCann, William S.....	420
Higgins, A. R.....	1243	McCarthy, Frank W.....	1010

	PAGE		PAGE
McCorkle, James K.....	1163	Pizzi, Francis W.....	1010
McCoy, Donald F.....	374	Poppen, John R.....	600
McDaniel, Walter S.....	664	Raffetto, Edward C.....	1238
McDermott, Kenneth F.....	739	Raskin, Herbert A.....	490
McGinn, Sylvester.....1,	1157	Ratcliff, Perry A.....	720
McGuire, William P.....	1239	Restarski, Joseph S.....	58
McLaughlin, Charles W., Jr....	46	Ricchiuti, Joseph F.....	1031
McLaughlin, Richard F.....	122	Richter, John W.....	498
McLaughlin, Robert R. M.....	762	Roberts, Gilbert J.....	1216
McNair, Stirling S.....	532	Rochester, Alfred M.....	504
Macintyre, Dual A.....	355	Rosenberg, David H.....	281
Macke, Ronald L.....	17	Ross, Clarence W.....423, 997,	1028
Marquis, John N.....	922	Russell, William M.....	100
Marshall, James M.....	743	Ruzicka, Edwin R.....	304
Maxwell, Merritte M.....	567	Saxl, Newton T.....	175
Mayer, Byrne W.....	355	Sayer, Arthur.....	338
Mayer, Henry, Jr.....	463	Schlossberg, Leon.....	1088
Mearin, Robert J.....	1137	Schneierson, Samuel J.....	766
Menville, John G.....423, 997		Schneierson, Sol S.....	391
Meradith, Mack.....	771	Schuyler, Clyde.....	297
Meredith, William C.....	1017	Schwab, William J.....	371
Metcalf, Ralph J.....	859	Schwartz, Walter H.....	193
Michael, Paul.....	122	Scott, Wendell G.....	234
Michel, Albert J.....	930	Seligmann, Arthur W., Jr....	433
Milles, George.....	376	Sellards, A. W.....	420
Monat, Henry A.....	459	Sherman, Samuel R.....	590
Moore, Charles M.....	729	Short, James J.....	974
Moore, Moore, Jr.....	1036	Smith, Joseph G.....	546
Moran, Thomas J.....	1128	Spence, Harry M.....	763
Morton, Harry E.....	409	Spingarn, Clifford L.....	717
Mrazek, Charles.....	1044	Sprague, Howard B.....1,	1014
Mullen, Edward A.....	32	Stearns, A. Warren.....	13
Muller, Charles N.....	376	Steiner, Morris.....	216
Murphey, Phelps J.....	1085	Stringer, John T., Jr.....	970
Murphy, Willis A.....	321	Stubenbord, William D.....	154
Myers, William A.....	1067	Sullivan, Daniel J.....	157
Newman, Louis B.....	559	Sullivan, Raymond R.....	90
Nicholson, Jesse T.....	63	Sulzberger, Marion B.....	889
Norris, Robert F.....	847	Sweet, A. Porter S.....	160
Olson, Clarence.....	80	Taubenhaus, Leon J.....	527
Ottaway, John P.....	1041	Taylor, K. P. A.....	25
Ouary, G.....	981	Thiemeyer, John S., Jr.....	372
Owens, J. Cuthbert.....	245	Thirlby, Richard L.....	1232
Owrutzky, Bernard.....	717	Thompson, Charles M.....	1220
Pardoll, Davis H.....	988	Twiss, John R.....	1001
Parker, Leon O.....	325	Ulen, Francis G.....	1145
Pattison, Donald H.....	278	Ungar, John, Jr.....	859
Pereyra, Armand J.....	189	Vaughan, Homer C., Jr.....	297
Perisho, Gordon M.....	216	Venner, Robert B.....150, 739,	955
Peterson, Paul.....	1251	Vickers, Harry D.....	513
Phillips, Kenneth.....	1193	Wagner, Joseph A.....	1034

	PAGE		PAGE
Wald, Samuel S.....	1200	Will, Otto Allen, Jr.....	909
Waterman, Julius L.....	223	Williams, James N.....	311
Watkins, George Linn.....	1038	Williams, Stanley B.....	44, 316
Webster, George V.....	878	Willson, Robert C.....	376
Weeks, Dana A.....	1171	Winblad, Frits A. S.....	1141
Wheeler, J. A., Jr.....	44, 316	Witwer, Russell G.....	34, 366
Whitaker, Walter M.....	650	Wood, Harold.....	4
White, Don P.....	901	Woods, Walter A.....	1137
White, Frank S.....	355	Yarrington, Charles T.....	355
Wildebush, Frank F.....	937	Zeve, Herman S.....	391, 429

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

AN INITIAL FINE OF 25 CENTS
WILL BE ASSESSED FOR FAILURE TO RETURN
THIS BOOK ON THE DATE DUE. THE PENALTY
WILL INCREASE TO 50 CENTS ON THE FOURTH
DAY AND TO \$1.00 ON THE SEVENTH DAY
OVERDUE.

Biology Library

DEC 29 1945

MAY 11 1951

MAY 31 1946

MAY 8 1951

APR 30 1947

MAY 25 1951

MAY 14 1951

JUL 17 1947

MAY 3 '58

MAR 10 1948

MAY 4 '58 JG

APR 29 1948

JAN 6 1962

DEC 20 1961

MAY 6 1948

MAY 26 1948

JUN 18 1971

JUN 7 1971 13

MAR 22 1949

NOV - 8 1949

MAR 31 1950

Apr 1950
MAY 13 1950

AUG 22 1950

APR 15 1951

APR 1 1951

LD 21-10m-5,'43 (6061s)

M256725

R11

U55

v. 43

BIOLOGY
LIBRARY

THE UNIVERSITY OF CALIFORNIA LIBRARY

